OPTAIN

Optimal Strategies to Retain Water and Nutrients

D2.1: Coherent catalogue with a selection of most promising NSWRM including results from MARG exchanges

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Summary

During the first reporting period, the task 2.1 partners focused on framing the concept of *Natural Small Water Retention Measures (NSWRM)* and on identifying and documenting existing and underutilised NSWRM in all 14 case studies (CS) of OPTAIN. Therefore, a systematic approach was developed involving all relevant stakeholder groups in Multi Actor Reference Groups (MARG), comprising the following steps:

i) identification of existing or potentially suitable measures,
ii) prioritisation of measures with a high potential in the local context of the different case studies,
iii) selection of a set of 3 to 7 measures per case study, which are relevant for the case studies and the OPTAIN project.

Once the NSWRM have been selected, all case study implementers started to collect data on their individual measures and to document them by using the World Overview of Conservation Approaches and Technologies (WOCAT) questionnaire on Sustainable Land Management (SLM) Technologies, thus generating a standardised factsheet of each measure. All entered data on the WOCAT SLM database will then be linked to the Natural Water Retention Measure (NWRM) platform. The OPTAIN catalogue will be accessible from both websites as well as through the project's own "Learning Environment" which will include a section dedicated to OPTAINs catalogue of NSWRM.

Overall, the prioritization in the 14 case studies resulted in 66 selected NSWRM. The case study teams started documenting these selected NSWRM with the World Overview of Conservation Approaches and Technologies (WOCAT) Technology questionnaire, including description and classification, technical specification, implementation inputs and costs, natural and human environment, as well as ecological, socio-economic and socio-cultural impacts. To help in this process, a two-day virtual WOCAT training for all case study teams was organised and conducted by the task 2.1 team.

In parallel, the task 2.1 partners conducted an analysis of the commonalities and differences between both WOCAT and NWRM.eu databases to provide an integrated view. The result of this analysis was d that there are only a few differences and a smooth integration could be possible. All entered data on the WOCAT global SLM database (https://qcat.wocat.net) will thus be linked to the NWRM platform (http://nwrm.eu/).

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Abbreviations

API	Application Program Interface
CS	Case Study
CTF	Controlled Traffic Farming
CDE	Centre for Development and Environment
MARG	Multi-Actor Reference Group
NSWRM	Natural/Small Water Retention Measures
NWRM	Natural Water Retention Measure
SLM	Sustainable Land Management
SWRM	Small (technical) Water Retention Measures
WFD	EU Water Framework Directive
WOCAT	World Overview of Conservation Approaches and Technologies
WP	Work Package

1. Introduction

1.1. Purpose of a coherent catalogue on NSWRM

The OPTAIN project relies on the selection and combination of clearly delineated ecosystem based technologies called Natural Small Water Retention Measures (NSWRM). To foster measure implementation, it is necessary to present the knowledge in an easy to use and meaningful manner. This allow framing the measures and their distinct characteristics, as well as collect and organise data and information on each of them.

To gather and organise the knowledge on NSWRM that is collected and created by OPTAIN, this deliverable aimed at the development of a catalogue of NSWRM. It presents each NSWRM considered in the project and contains all the associated information. The objective is to make qualitative and quantitative information on each specific measure available to all end users and NSWRM implementers. It enables them to select, design and implement one or more NSWRM on their farm (or territory), or extract specific data and information they need for supporting the development and promotion of NSWRM use. The NSWRM will be integrated in the World Overview of Conservation Approaches and Technologies (WOCAT) Global Sustainable Land Management (SLM) Database (WOCAT, 2022) and linked to the Natural Water Retention Measure (NWRM) catalogue (NWRM, 2019). This integration into the two long-standing databases ensures the dissemination of OPTAIN knowledge beyond the project consortium and the project lifetime. Without additional resources, the documented NSWRM will be available through WOCAT for the global SLM community and through the NWRM Platform for the European NWRM experts and implementers. All the information collected will finally be integrated into the OPTAIN Learning Environment, where all NSWRM can be accessed through various access points. The aim of the Learning Environment is to gather the OPTAIN products and results and provide it in a flexible and meaningful manner to the different end-users, from the scientific community to farmers and a wide set of stakeholders.

1.2. From NWRM and SLM to NSWRM

1.2.1. The case of NWRM

In the second cycle of implementation of the EU Water Framework Directive - WFD (2000/60/EC), it has been recognised that Natural Water Retention Measures (NWRM) could be implemented to a wider extent and contribute significantly more to the achievement of good water status. Further work following this concluded that due to their multi-functionality, NWRM can be placed within the framework of three EU policy areas, namely the water policy, the policy on climate change (because NWRM increase resilience) and the green infrastructure policy (because NWRM are providing ecosystem services and consider nature and biodiversity). A large project aiming at creating a knowledge hub (http://nwrm.eu) was then conducted under the umbrella of the European Commission, which produced the conceptual framework, identified a list of 53 NWRM categories and gathered information on more than 130 past projects all over Europe that implemented one or more of these NWRM categories.

NWRM are defined as follows: *"Natural Water Retention Measures (NWRM) are multi-functional measures that aim to protect and manage water resources and address water-related challenges by restoring or maintaining ecosystems as well as natural features and characteristics of water bodies using natural means and processes. Their focus is to enhance, as well as preserve, the water retention capacity of aquifers, soil, and ecosystems with a view to improving their status. NWRM have the potential to provide multiple benefits, including the reduction of risk of floods and droughts, water quality improvement, groundwater recharge and habitat improvement. The application of NWRM supports green infrastructure, improves or preserves the quantitative status of surface water and groundwater bodies and can positively affect the chemical and ecological status of water bodies by restoring or enhancing natural functioning of ecosystems and the services they provide. The preserved or restored ecosystems can contribute both to climate change adaptation and mitigation."*(DGENV, 2015)

Currently there are 53 measure on the NWRM platform, which, for ease of use, have been organised in four geographical sectors named (agriculture, forest, urban, hydro morphology: this last corresponds to rivers and their surrounding environment). These sectors refer to the geographical location in which the measures are typically implemented but any measure can be implemented in all parts of the territory, because in general, a territory is a mixture of the four main inland use types, and frontiers between them are soft. For instance, the frontier between "A02 Buffer strips and hedges" and "F01 Forest riparian buffers", lies mainly on the type of vegetation used, or "U04 Swales", can be used to manage rainwater or excess water in forest or agriculture territory. The nwrm.eu platform has been developed to provide clear and structured access to knowledge. On the platform, each measure is described in detail in a dedicated factsheet and linked to a set of case studies, which have implemented one or more measures. The factsheets are accessible via the NWRM catalogue as can be seen in the following screenshot.

AGRICULTURE	
A01	Meadows and pastures
A02	Buffer strips and hedges
A03	Crop rotation
A04	Strip cropping along contours
A05	Intercropping
A06	No till agriculture
A07	Low till agriculture
A08	Green cover
A09	Early sowing
A10	Traditional terracing
A11	Controlled traffic farming
A12	Reduced stocking density
A13	Mulching

FOREST	
F01	Forest riparian buffers
F02	Maintenance of forest cover in headwater areas
F03	Afforestation of reservoir catchments
F04	Targeted planting for 'catching' precipitation
F05	Land use conversion
F06	Continuous cover forestry
F07	'Water sensitive' driving
F08	Appropriate design of roads and stream crossings
F09	Sediment capture ponds
F10	Coarse woody debris
F11	Urban forest parks
F12	Trees in Urban areas
F13	Peak flow control structures
F14	Overland flow areas in peatland forests

HYDRO MORPHOLOGY	
N01	Basins and ponds
N02	Wetland restoration and management
N03	Floodplain restoration and management
N04	Re-meandering
N05	Stream bed re-naturalization
N06	Restoration and reconnection of seasonal streams
N07	Reconnection of oxbow lakes and similar features
N08	Riverbed material renaturalization
N09	Removal of dams and other longitudinal barriers
N10	Natural bank stabilisation
N11	Elimination of riverbank protection
N12	Lake restoration
N13	Restoration of natural infiltration to groundwater
N14	Re-naturalisation of polder areas

URBAN	
U01	Green Roofs
U02	Rainwater Harvesting
U03	Permeable surfaces
U04	Swales
U05	Channels and rills
U06	Filter Strips
U07	Soakaways
U08	Infiltration Trenches
U09	Rain Gardens
U10	Detention Basins
U11	Retention Ponds
U12	Infiltration basins

Figure 1: Groups of NSWRM Categories (NWRM, 2019)

It should be noted that a NWRM factsheet describes a measure in broad terms. The exact technical details of its implementation is left to the implementers and the case studies on the nwrm.eu platform are showing possible options to implement the measure, but other options may exist. The objective of this approach was to allow some flexibility in the NWRM implementation while providing a clear framework for all.

1.2.2. The case of WOCAT

While the NWRM.eu platform focuses specifically on NWRM in the European context, the World Overview of Conservation Approaches and Technologies (WOCAT) focuses on the broader concept of Sustainable Land Management from local to global levels. WOCAT was founded in 1992 as an informal global network of soil and water conservation specialists. It was one of the first programmes to promote resource conservation and SLM in response to land degradation. WOCAT developed standardised tools for documenting, monitoring, and evaluating SLM know-how as well as disseminating it around the globe, enabling land users to exchange experiences. Since then the standardisation was further developed and WOCAT now offer a full database referencing WOCAT SLM Technology Groups. Individual factsheets are referencing a

wide set of individual SLM that are applied on a specific area and gathered in the WOCAT Global SLM Database (WOCAT, 2022).

It should be noted that an SLM factsheet is the exact application of a specific technique on a specific location, a kind of NWRM case study but narrowed down to a single technology. This is an important conceptual difference to the NWRM platform. A measure factsheet on the NWRM platform is more similar to an SLM group in WOCAT, but with a more detailed description. That means it is not only a definition but also illustration and list of benefits, and a NWRM case study is more similar to a set of different SLMs applied in the same area.

This is important for OPTAIN, which aims to implement different NSWRM in 14 case studies and to document each measure in a detailed manner: the SLM factsheet is therefore more adequate to document a NSWRM than a NWRM case study factsheet.

1.2.3. The case of NSWRM

Under the WFD, it has been recognised that agriculture is a major contributor to the pressures stemming from human activities on freshwater, especially regarding pollution from nutrients and abstraction of water. Water and soil are by nature closely related. On the other hand, agriculture is a key actor in landscape management and could make more use of simple NWRMs to reduce its pressures on freshwater ecosystems and also benefit from some ecosystem services these measures provide (retention of water, of nutrients, erosion reduction…).

In OPTAIN perspective NSWRM are defined as follows in the call SFS23-2019 *"NSWRM (that are in the scope of this call) are in line with the NWRM concept, but also include Small technical water retention measures (SWRM), like small hydro-technical systems (small reservoirs, damming on watercourses) and new methods for utilizing existing water systems (e.g. melioration systems), which require active human involvement in the maintenance and exploitation of existing water systems (GWP CEE, 2015)."*

NSWRM therefore include NWRM, SWRM which may or not have all characteristics of NWRM and other measures related to water systems. The specificities of NSWRM focuses on are:

- catchments with land occupation mostly of agriculture and forestry categories, covering headwaters,
- small and simple measures allowing easy implementation,
- retention, recovery and reuse of water, and of nutrients and sediments.

This can be translated in short as follows:

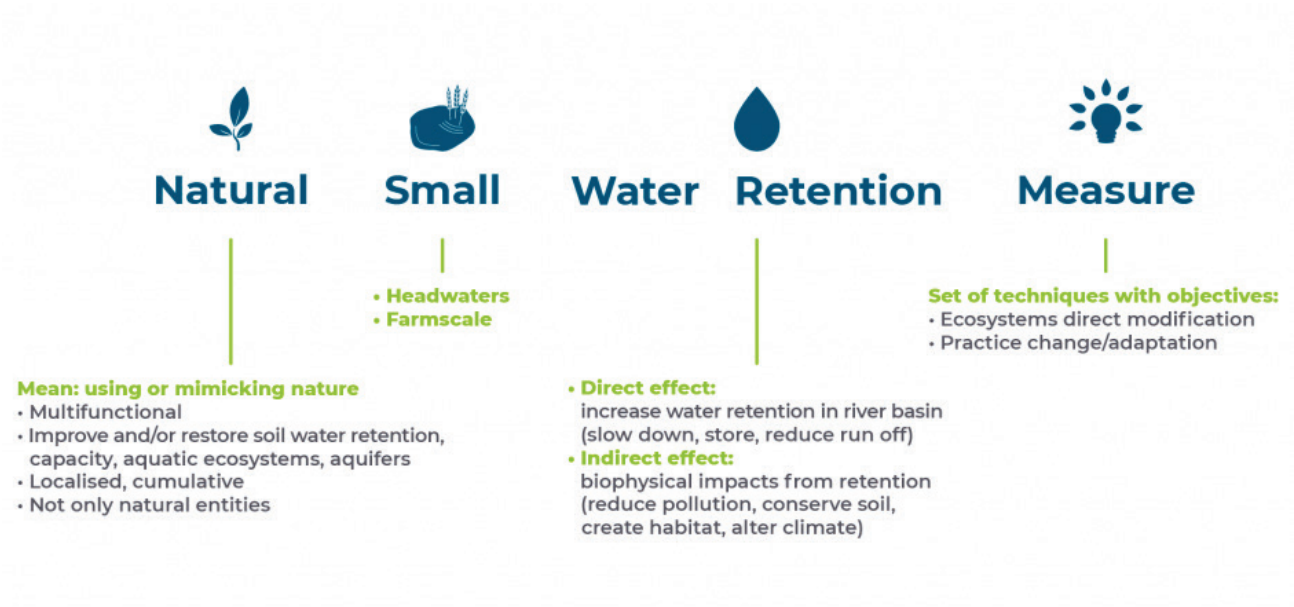


Figure 2: NSWRM Framework

NSWRM also go in line with the definition of SLM from WOCAT: by increasing retention, recovery and reuse of water, nutrient and sediment, they should also improve soil management.

NSWRM are in fact often a specific case of NWRM, i.e. a NWRM implemented in a specific location. For ease of understanding in the rest of the document, we will speak of "NWRM categories" to name individual NWRMs included in the catalogue of the NWRM.eu platform, because the same NWRM can be implemented in different contexts with different results. In OPTAIN, a number of NSWRM implemented will be linked to a single NWRM.eu category.

Considering the above, the use of existing tools from the NWRM website and WOCAT are relevant for the OPTAIN project to save time and resources.

This will also be useful for the explorative tools implemented in the Learning Environment, as it will allow relying on a larger number of selection criteria, better targeted to the different audiences of the project (see Figure 6).

2. Approaches and Methods

An important added value of OPTAIN is the harmonised approach the project aims for. This is done with the overall methodology developed and applied in 14 case studies, which implement a set of NSWRM on the ground. This is key for the knowledge development and based on the involvement of end-users from the beginning. This was done via so-called Multi Actors Reference Group (MARG) involved in the co-creation of the knowledge on NSWRM. The following step-by-step approach was used:

i) identification of existing or potentially suitable measures,
ii) prioritisation of measures with a high potential in the local context of the different case studies,
iii) selection of a set of 3 to 7 measures per case study, which are relevant for the case studies and the OPTAIN project,
iv) documentation of the measures selected to generate a standardised factsheet of each NSWRM.

2.1. Identification of measures

In a first step, the lead partners of task 2.1 elaborated a questionnaire on existing and potentially suitable NSWRM to gather primary information on the local measures with their link to WOCAT SLM groups, and to the NWRM categories.

The questionnaire included the following questions:

- Country
- Case study name
- Biogeographical Region
- Locally used name
- Name of the NSWRM
- NWRM category
- Implementation status
- Land use type
- Short description
- Main purpose(s) of the NSWRM
- Strengths of the measure
- Weaknesses of the measure
- Area covered by measure
- Location of existing NSWRM
- Cost/Benefit: short-term & long-term
- Potential for spread
- On-site impacts (socio economic, socio-cultural and ecological)
- Off-site impacts
- Subsidies or other support
- Type of support
- Feasibility / Applicability
- Used decision support during testing/implementation phase
- Available surveys/ reports/ measurement that can be used to evaluate effects
- Type of functioning on water balance / runoff
- Type of functioning on water quality
- Estimated non-professional average efficiency on water balance
- Estimated non-professional average efficiency on water quality

All case study teams filled the questionnaire. Some for less than five NSWRM while others identified more than 25 existing and potentially suitable NSWRM for their case study. The results of the description of each case study measure were compiled for OPTAIN milestone MS4, which included a total of 212 NSWRM from all case studies. These measures were then analysed against NWRM categories and WOCAT SLM Groups, considering also potential remaining questions on their relevance. After the first series of MARG workshops (see next chapter), a few case studies further added some locally relevant NSWRM which were missing from the stakeholders point of view. Finally, a list of 235 existing or potentially suitable NSWRM from all OPTAIN case studies were obtained.

The analysis of this final list showed that among the proposed measures:

- Some retention and management of water and sediment can easily be linked to existing NWRMs, or split into a set of NWRM,
- Some could be proposed as new NWRM,
- while those related to drainage and recovery of water and nutrients with a limited or no retention effect cannot be linked to any NWRM. For these last a specific category called “drainage” is created and on the other hand kept as “not defined”.

2.2. Prioritisation of measures

In the first series of MARG workshops, the selected existing and potentially suitable NSWRM were discussed with different stakeholder groups in all 14 case studies. The stakeholders discussed which NSWRM could be adequate, potentially interesting and feasible for the local context and added new measures to the list, which were missing from their point of view. These additional NSWRM have been collected and added to the initial list of existing and potentially suitable NSWRM from step 1.

To guide the 14 case study leaders during the first series of MARG workshops, WP2 elaborated a common guideline on measure prioritisation. This guideline was based on a broader methodology developed by the Centre for Development and Environment (CDE), University of Bern, Switzerland, as part of the EU FP6 project DESIRE (Schwilch *et al.*, 2009). For OPTAIN, selected chapters have been shortened and adapted to serve the project’s objectives.

Due to COVID-19, it was not possible to organise a physical workshop in all 14 case studies, therefore WP2 elaborated guidelines for both virtual and physical versions of the workshop (see Annexes 1 & 2)

The guidelines included practical hints for organizing workshops (physically and virtually), a suggested agenda for the 3h workshop and a detailed description of every agenda point:

- Introduction to the workshop
- WP2 component: Identify existing and potentially suitable NSWRM
    - Exercise #1: Assessment of measures
    - Exercise #2: Rate NWRMs and pre-selection
- Closing of the workshop

All results, chosen/adapted approaches, difficulties encountered, and recommendations were compiled with a workshop report of each case study. The prioritisation of NSWRM

that are relevant in a local context served as a basis for the final selection of measures for the assessment, documentation and modelling throughout the upcoming OPTAIN project period.

2.3. Selection of measures

Based on the prioritisation of NSWRM by the local stakeholders, the OPTAIN case study teams selected 3-7 measures that are relevant for the specific case study area. The selections have been discussed between the case study teams and the WP2 team to ensure that not all case studies are documenting the same types of NSWRM and that all - for OPTAIN relevant - NWRM categories are represented by at least one NSWRM in an OPTAIN case study.

For the final selection of NSWRM, which will be assessed, documented, and modelled in each case study, the following criteria have been considered:

- It is classified as NSWRM,
- It is relevant for the individual case studies,
- It can be represented in the models used in OPTAIN,
- Expertise and experience is available.

Overall, the prioritisation and selection in the 14 case studies resulted in **66 selected NSWRM,** which are representing **29 OPTAIN relevant** NWRM categories and will be included in OPTAINs catalogue of NSWRM.

2.4. Documentation of measures

NSWRM in OPTAIN correspond to the implementation of a technical measure in a specific biogeographic and biophysical context. For the NWRM website (http://nwrm.eu/) it corresponds to a "NWRM case study" but restricted to a single measure. In the WOCAT database, a NSWRM corresponds to a "SLM Technology" for which a factsheet will be available, describing in detail the NWSRM implemented in its specific context. The resulting set of SLM/NSWRM factsheets are the basis of OPTAINs catalogue of NSWRM.

After the NSWRM have been selected, all case study implementers started to collect data on their individual NSWRM and to document them with the WOCAT questionnaire on SLM Technologies (WOCAT, 2019) to generate on the WOCAT database a standardised factsheet of each NSWRM.

This step is based on a workflow that started with the training of the experts, who will populate the NSWRM factsheets, followed by a first drafting of the content, and finally by an expert validation and review process that may imply revision until final publication.

Once published in the WOCAT database, all entered data will be linked to the NWRM.eu platform and included in the catalogue of OPTAINs Learning Environment. Even if the Learning Environment is the main entry point for OPTAINs catalogue of NSWRM, it will be accessible from the other platforms as well.

The detailed workflow for the documentation is presented in the following:

In a 2-day virtual training event for NSWRM documentation organised 22 and 23rd of June 2021, the case study teams learned how to document the selected NSWRM on the

WOCAT global SLM Database and the NWRM platform. The main objectives of the training were:

- Everybody knows WOCAT and the NWRM framework
- All case studies start documenting own NSWRM on the WOCAT global SLM database
- All case studies are aware of what additional information is missing and how it can be collected (for WOCAT, NWRM and other OPTAIN WPs)

With this background, the case study teams started documenting their selected NSWRM by means of the WOCAT Technology questionnaire. This questionnaire helps to describe and understand the NSWRM by addressing the following questions: What are the specifications of the measure? What are the inputs and costs? Where is it used (natural and human environment)? What impact does it have?

Once the case study teams, along with their local resource associates, enter all required information into the WOCAT database, the NSWRM documentation are being submitted for a WOCAT internal review. The review process ensures the description is comprehensive and the entered data is complete before the documented NSWRM is published on the WOCAT global SLM database.

An additional WOCAT module offers the possibility to elaborate a GHG assessment of individual published NSWRM with the linked Carbon Benefit Project (CBP) tools. A training will therefore be provided to all interested case study members to get a rough estimate of the greenhouse gas balance of selected NSWRM.

With the standardised PDF (NSWRM factsheet) that can be generated online for every NSWRM already at a draft stage and the option to access all the data through a well described Application Program Interface (API), WOCAT is the basis for OPTAINs coherent catalogue of measures. The systems can be grouped by different preferences and possibilities.

Once the NSWRM are published on the WOCAT SLM database, a link will be established to the NWRM.eu platform. The two will then be used to feed the OPTAIN Learning Environment where the documented NSWRM will be accessible through the OPTAIN relevant NWRM categories, along with the SLM groups and NWRM categories. The NSWRM factsheets will also be used to provide, within the Learning Environment, various outputs useful for the end user, e.g.: pre-identified summary tables and figures, selection of sub-sets of factsheets selected by the user, customisable queries allowing to present or extract relevant information.

3. Results

3.1. MARG workshops

An important goal of the first series of OPTAINs MARG workshops in 2021 was to identify currently existing and potentially suitable NSWRM in the case study areas. For these workshops, WP2 had prepared detailed methodological guidelines (see Annexes 1 & 2). Due to the COVID-19 related impacts, most workshops were held in online formats and only a few workshops were possible in physical meetings. Below we summarize some of the reported details, observations and lessons learned. A list with all details on the different MARG workshops can be found in Annex 3.

3.1.1. Meeting type

Seven case study sites carried out online meetings, five case study sites carried out physical meetings, and one case study site (Norway) changed the procedure by linking the workshop to two already planned physical meetings.

Further details about the virtual meetings

- Seven case study sites carried out virtual meetings with participants in the range of 11 to 28 people. The participants were mainly from the following stakeholder groups: national, regional and/or local authorities, NGOs, private companies, farmers, agricultural advisors, consultants, and scientists /scientific experts. In five of the seven workshops farmers were present.
- Software used for the meeting and prioritisation: One case study site used the Cisco-Webex software (Germany), two case study sites used the Zoom software (Hungary) and the others did not specify the software they used. For the polling exercise, two case study sites (Germany, Belgium) used menti.com, two case study sites (Hungary) used the poll functionality of Zoom, one case study site (Italy) used a questionnaire and the other two sites (Lithuania and Italy) did no prioritisation.

Further details about the physical meeting

- Five case study sites carried out physical meetings with participants in the range of 8 to 24 people. The participants were mainly from the following stakeholder groups: regional and/or local authorities, NGOs, private companies, farmers, agricultural advisors, consultants, and scientists /scientific experts. In all five case study sites, farmers were present.
- The procedure of the physical meetings was often adjusted and/or changed to better fit the local context. In one case study site (Poland), the workshop was combined with another on-going process of establishing a local water partnership and could therefore not follow the suggested procedure.

Other format

- Norway adapted the format and linking the workshop to two already planned physical meetings.

3.1.2. Difficulties encountered

COVID-19

- Five case study sites were able to organize physical meetings. The COVID-19 restrictions (e.g. certificate) and the short notice of the meeting due to COVID-19 conditions led to less attendance in three case study sites (Slovenia and Latvia).

- Many of the MARG kick-off workshops have been delayed due to the uncertain scheduling possibilities and limited availability of important contacts.

Internet issues

- Participants in two case study sites faced unstable internet or had internet issues in general and were not able to connect to the online meeting.
- Six of the seven case study sites conducting a virtual meeting concluded that online meetings are not an ideal format for farmers. Some of the farmers were not able to join the meeting because of this. One farmer was willing to join the meeting but had technical problems. Besides, in some case study sites, the meeting was taking place during busy working periods for farmers, and hence they were not able to join.

Time of the workshop / duration of workshop

- In three case study sites, farmers did not attend the online meeting due to various reasons, e.g. busy time, due to many online meetings.
- In two case study sites, farmers did not attend the physical meeting due to the need of a COVID-19 certificate.
- Three case study sites conducting a physical meeting felt that the allocated time was too short. It was not possible to discuss all measures in detail. Likewise, one case study site conducting an online meeting felt that the time was too short.

Isolated view on measures

- In two case study sites (Germany, Switzerland) the participants were not happy to have an isolated view on single measures. They rightly noted that some measures only work properly in combination with other measures (e.g. for conservation or no-till, you need diversified crop rotations and you also do mulching). They preferred to keep the holistic view and to look at the objectives in general.
- Stakeholders had problems in understanding the concept of measures as technologies and focused too much into the aims/objectives of the measures; i.e. they want improved soil health in general but could not prioritize single measures to get there (Switzerland).
- Measures brought up later (after the workshop) by the participants (sent by Email) could not be discussed and prioritised (Germany).

Moderation of discussion

- In one case study site, a few participants dominated the discussion during the physical meeting (Switzerland). Likewise, there were silent listeners during the online meeting in Lithuania.
- In one case study site, it was difficult to keep the discussion restricted to the measures, other topics were discussed leading to less time to discuss the measures (Poland).

3.1.3. General observations

- Physical meetings are preferred over online meetings (especially by farmers).
- Busy farming times should be avoided to organize the meeting.
- Some case study sites preferred to organize a general “get to know each other” meeting first, before selecting and prioritizing the measures.

- The equal participation in the workshop of the different participants must be carefully moderated (to avoid monopolisation of the meeting by a few participants). A case study site had an agriculture extension worker as workshop moderator, which was very useful, as he knew the study site and the stakeholders (Switzerland).
- "Isolated view of measures" versus "holistic view of measures": the holistic view of measures / combination of measures should also be taken into account during the workshop discussion.

3.2. Identification and selection of measures

With the questionnaire on existing and potentially suitable NSWRM and the additionally identified measures from the first series of MARG workshops, the case study teams identified a total of 235 NSWRM distributed over 42 different NWRM categories. Of these, 66 measures from 29 NSWRM categories were finally selected for OPTAINs catalogue of NSWRM (see this section).

Some of those measures are already implemented in the case studies (existing NSWRM), some are planned to be implemented soon (planned NWRMs) and some present good potential to be implemented (potential NWRMs). More than 50% of the identified NSWRM could be assigned to NWRM sector Agricultural Measures (118), including green cover (18 measures), buffer strips and hedges (18), no till agriculture (12), crop rotation (11) or strip cropping along contours (11). The NWRM sector of Hydromorpholgy accounts for 52 of the identified NSWRM, which belong mainly to basin and ponds (14), wetland restoration and management (12), stream bed re-naturalisation (7), natural bank stabilisation (6) as well as floodplain restoration and management (6). Only 17 measures belong to the NWRM sector Forest (mainly related to forest riparian buffers and land use conversion) and 12 to Urban (mainly retention ponds and detention basins). In total 36 identified measures could not be allocated to the current NWRM categories. Most of these measures could not be qualified as NWRM because they do not fulfil the criteria defined in chapter 1: they are too broadly defined and need further disaggregation or they relate to increase of drainage. Furthermore, a few measures fulfil the NWRM criteria but cannot be allocated at a NWRM category so far (e.g. deep ploughing and other soil management). For these measures a new NWRM category will be developed.

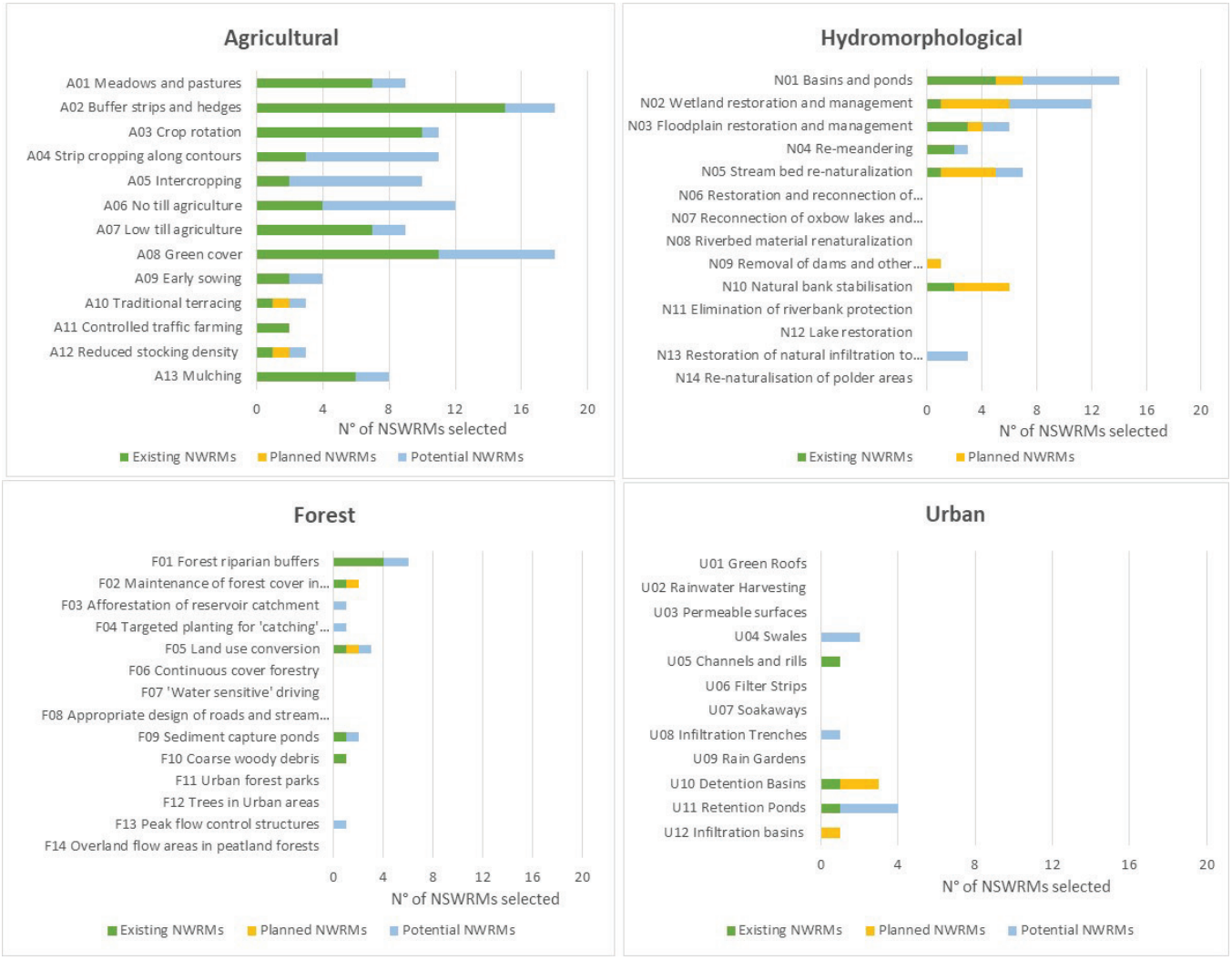


Figure 3: NWRM categories of the four NWRM sectors with the number of identified NSWRM in the case studies of OPTAIN.

As NSWRM also go in line with the WOCAT definition of Sustainable Land Management, we also analysed how the WOCAT SLM Technology Groups are represented in the identified NSWRM. Results show that the most important SLM groups are improved ground/vegetation cover (45) and surface water management (46). Other SLM groups that are relevant are: natural and semi-natural forest (26), cross slope measures (24) as well as and minimal soil disturbance (24).

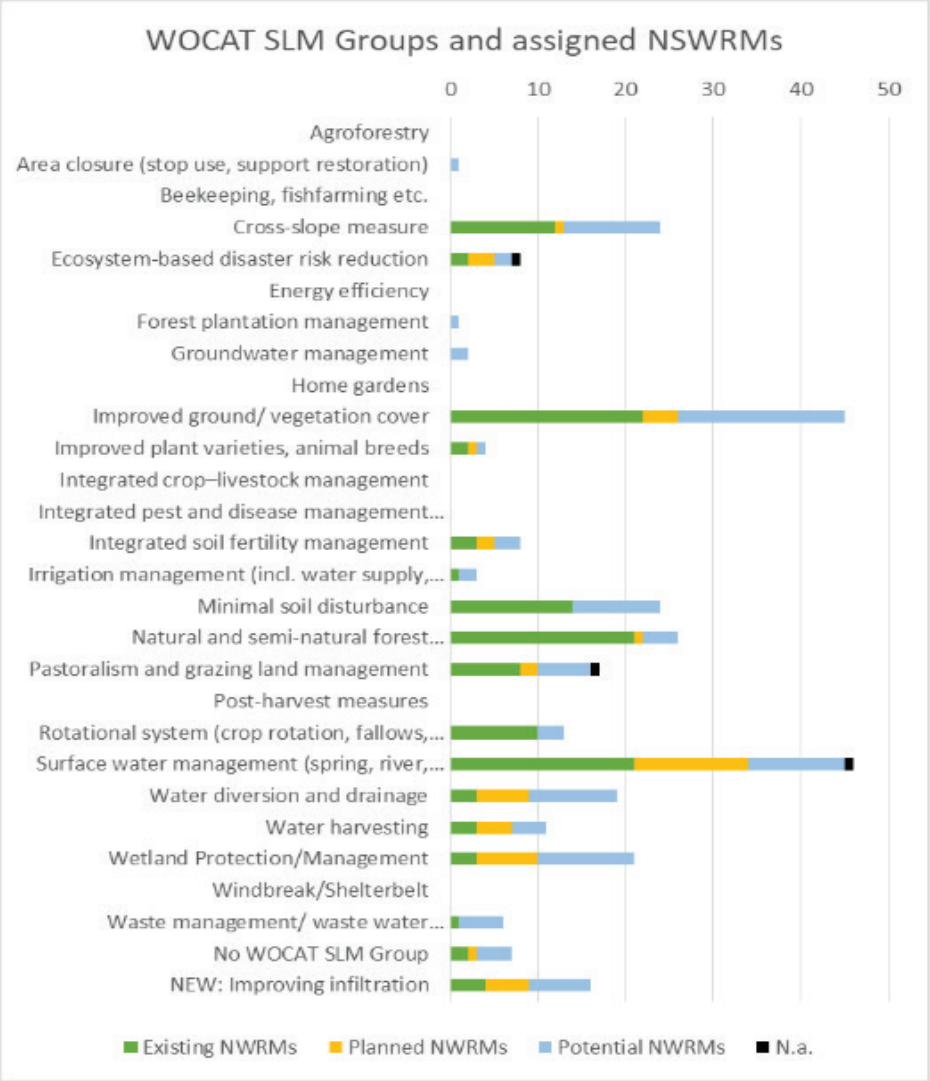


Figure 4: WOCAT SLM groups with the number of identified NSWRM in the case studies of OPTAIN.

Out of these 235 identified measures, the case study teams, local stakeholders and the WP2 team finally selected 66 locally relevant NSWRM that are representing 29 NWRM categories that are relevant for the objectives of OPTAIN. They are presented in Chapter *3.3 OPTAINs catalogue of NSWRM*. Many NWRM categories are only represented by one or two selected NSWRM, but other categories contain several selected individual NSWRM, such as buffer strips and hedges (10), green cover (5), no till agriculture (4), and wetland restoration (4). Two selected NSWRM relate to management of drainage systems, which is relevant for OPTAIN but cannot be qualified as NWRM and four NSWRM could not be allocated to the existing categories of NWRM. Depending on the richness of the information collected, they may be used to document a new NWRM category or be kept separated, as they are found relevant for the OPTAIN project.

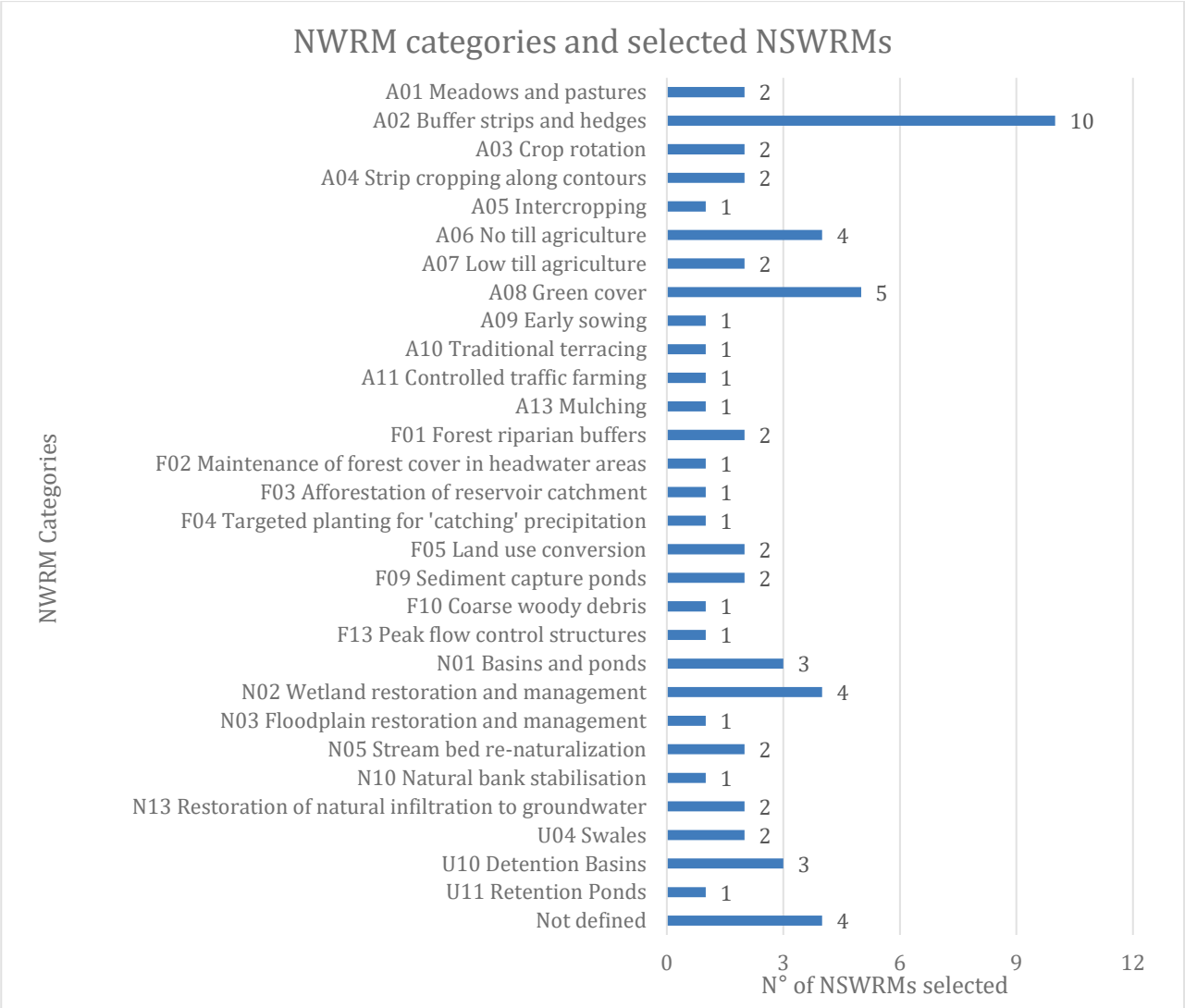


Figure 5: NWRM categories with the number of selected NSWRM in OPTAIN.

As a detailed documentation was not available for all NSWRM in all OPTAIN case studies before the finalization of this deliverable report D2.1, an overall analysis of all selected measures was not possible. Instead, we refer to OPTAINs deliverable D4.1 “Assessment of local condition important for NSWRM implementation”, which analysed the identified and relevant NSWRM regarding their impact, implementation possibilities, and requirements for certain conditions, based on the 235 identified measures. Čerkasova and Idzelytė (2021) found in deliverable D4.1 that the indicated measures generally address several challenges of the case studies, based on their location, extent and maintenance, or other variables. Some “speciality” measures like A03 Crop rotation (addresses soil quality) can have a positive effect on the quality of water bodies in terms of removing pollutants and combating eutrophication. While others, like A01 Meadows and pastures, A09 Early sowing, A11 Controlled traffic farming, U11 Retention Ponds, have an effect on almost all the identified challenges. The possibility of measure implementation and the degree of their potential effects are largely dependent on other conditions, properties of the catchment and the implementation status of other measures (Čerkasova & Idzelytė, 2021, Figure 3).

3.3. OPTAINs catalogue of NSWRM

3.3.1. Overall set-up

The catalogue will be embedded in the OPTAIN Learning Environment as illustrated in the following figure:

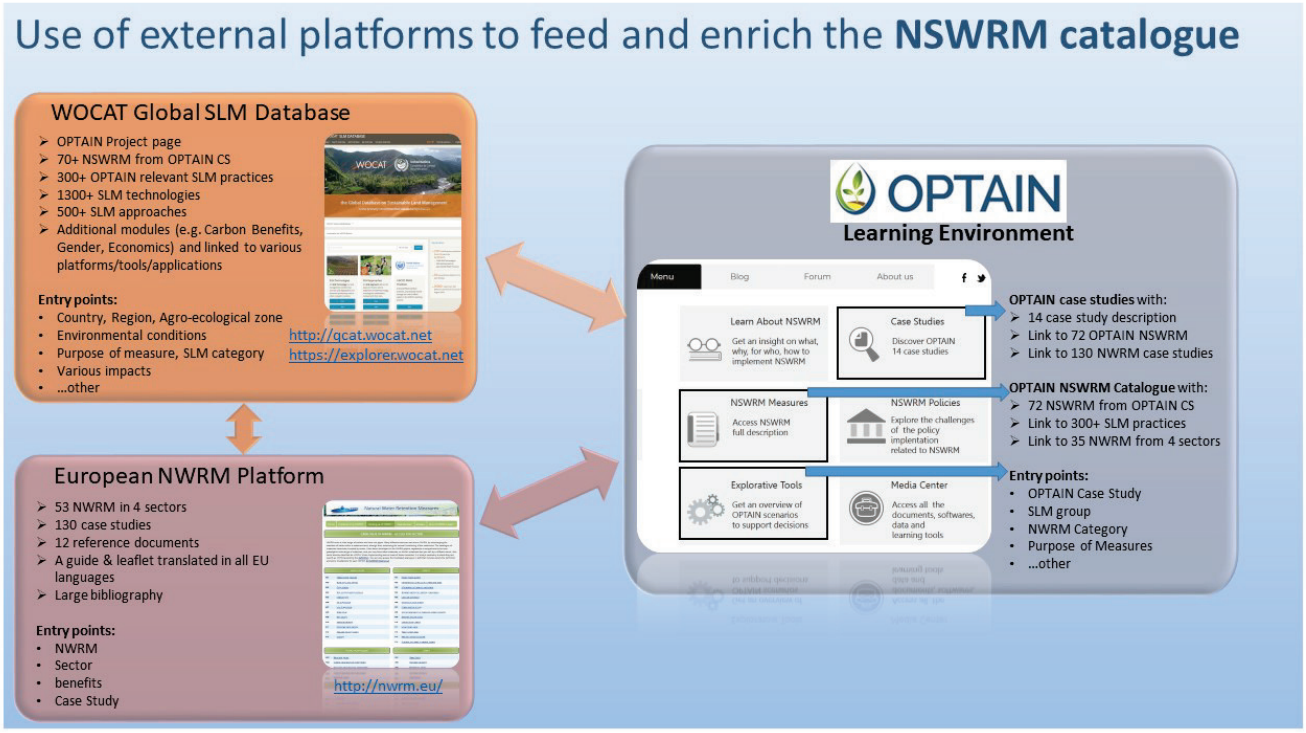


Figure 6: Setting up the OPTAIN catalogue

It will be accessible directly but also via other parts of the Learning Environment like the explorative tools which should allow queries it and extraction of relevant information for the end users. Furthermore, an entry point is planned via the case studies selection of the Learning Environment, which will present (inter alia) the set of measures implemented for a specific case study. Individual measures will be accessible as soon as the workflow described in the chapter 2 is finished and the factsheet is public.

The selected 66 NSWRM from the 29 NWRM categories will be the core of OPTAINs catalogue of NSWRM. All these measures are now being documented with the WOCAT global SLM database in a standardised way. Through the WOCAT database all data can be accessed either through an automatically generated PDF with a unique URL for each measure (see next section), by using the database visualisation explorer or with a unique URL for OPTAIN (https://explorer.wocat.net/).
Finally, it is also possible to access it through an Application Program Interface (API) https://qcat.readthedocs.io/en/latest/api/v2.html where users can access all information from selected or all measures.

All documented NSWRM will also be linked to the NWRM.eu platform, where the measures will be accessible through the different NWRM sectors and categories.

Both, the WOCAT database and NWRM.eu, will finally be linked to the OPTAIN website and its Learning Environment to visualise the factsheets produced in the OPTAIN project

and to benefit from the standardisation and other reference systems available in these two catalogues. Once the full factsheets have been collected, and the end-users needs for the Learning Environment are defined more precisely, an investigation of the resulting database will be conducted to propose useful outputs using the catalogue of NSWRM and other resources produced by OPTAIN project. For instance, the tools which target the catalogue could enable the different user groups to access and group the NSWRM by different preferences (country, environmental conditions, or SLM groups), or extract some relevant values (minimum, range, maximum) from the quantitative information collected.

Example of NSWRM factsheet in the WOCAT SLM Database:

3.3.2. NSWRM by case study

Each case study team in the OPTAIN project documented 2-7 NSWRM on WOCAT. These measures are listed below. The documentation still need to be completed by the case study teams, before they go through a WOCAT internal review process and finally area available on the WOCAT Global SLM Database https://qcat.wocat.net with a unique URL for each NSWRM. The URL is being activated as soon the NSWRM documentation has been published.

Figure 7: OPTAIN case studies per biogeographical regions.

1 Germany - Schwarzer Schöps

Mulch seeding with permanent minimum tillage (A07 Low till agriculture)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6257

Mulch seeding with permanent minimum tillage is a form of conservation tillage where the plant residues of the preceding crop remain on the soil surface before and after seeding, thereby protecting the soil from erosion. A minimum (ploughless) soil cultivation is used to till the upper soil layer and create the seedbed.

Cover crops (A08 Green cover)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5929

Cover crops are planted to cover the soil rather than for being harvested. By leaving uprooted or sown crop parts to wither on a field, they serve as a mulch, soil amendment and fertilizer (green manure)

Grassed waterways (U04 Swales)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5935

Grassed waterways are broad, shallow and typically saucer-shaped channels with a vegetative cover designed to move surface water across farmland without causing soil erosion.

Hedgerows to subdivide larger fields (A02 Buffer strips and hedges)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6263

Hedgerows are an extremely valuable habitat for wildlife. Implemented on large cleared and intensively used agricultural fields, they can also serve as efficient shelter against wind and water erosion.

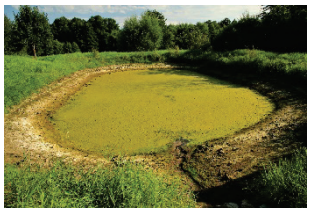
Edge-of-field filter & flower strips (A02 Buffer strips and hedges)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6264

Edge-of-field filter and flower strips are extensively used strips of land along the edges of agricultural fields, where natural field herbs can emerge or flower seed mixtures are sown (flower strips). Besides their main functionality of providing habitat to local flora and fauna, filter and flower strips form a barrier for surface runoff and erosion and increase infiltration.

Grassed riparian buffer strips (A02 Buffer strips and hedges)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6258

Permanent greening of arable land alongside surface waters to create riparian buffer strips with a width of 5 – 30m. The riparian buffer strip slows down runoff and reduces erosion as well as nutrient losses. It is not allowed to apply fertilizer and pesticides on these areas.

Retention or detention ponds (N01 Basins and ponds)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6265



Retention and detention ponds are artificially excavated basins that collect storm water runoff and eroded soil material, which is channelled to the basin from its upland catchment, stored and slowly released into a receiving water body or infiltrated into the groundwater. Their main function is flood protection, erosion control and improvement of the water quality.

2 Switzerland - Petite Glâne

Direct seeding (A06 No till agriculture)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1007/

A cropping system, which allows planting the seeds directly into the soil without ploughing. The soil is covered with plant remainders.

Maize strip tillage (A04 Strip cropping along contours)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1008/

Maize strip tillage is used for corn cultivation and the technology ensures that only those stripes are cultivated where seed is applied.

Slope subdivision through a field seam (A04 Strip cropping along contours)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1670/

A field at risk for erosion by water is divided so that grass strips/ hedges prevent soil loss and further damage to the field and the streets during a heavy rainfall.

Grain legumes intercropped with cereals and other partners (A05 Intercropping)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6235/

Integrates the use of woody perennials with agricultural crops and/or animals for a variety of benefits and services including better use of soil and water resources; multiple fuel, fodder and food products as well as habitats for associated species.

Riparian forest (A02 Buffer strips and hedges)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6248/

Riparian forests stabilize streambanks, slow down runoff water and increase infiltration into the soil. They provide a buffer between the river and adjacent land uses and are vital for ensuring a healthy watercourse.

Drought-resistant plants (Not defined)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6272/

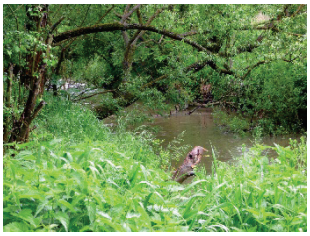
Development of new plant varieties that offer benefits such as improved production and drought tolerance, in response to changing environmental conditions.

3a Hungary - Csorsza

Green cover in vineyard (A08 Green cover)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6194

Grapevines with no tillage at older plants.

Coarse woody debris (F10 Coarse woody debris)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6197



Some forests are protected, there is no dead branch removal allowed

3b Hungary - Felso-Valicka

Land use change (F05 Land use conversion)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6198

Land use change: arable land-grass, arable land-forest, arable land-wetland conversion.

Meadows and pastures (A01 Meadows and pastures)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6195

Meadows are areas or fields whose main vegetation is grass, or other non-woody plants, used for mowing and haying.

4 Poland - Upper Zglowiaczka

Mulching (A13 Mulching)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6249

Mulching is the addition of undecomposed plant materials (commonly shredded), such as straw, hay or processing waste, to the soil under the plants. Sometimes it is practiced that crop residues are shallowly mixed with soil.

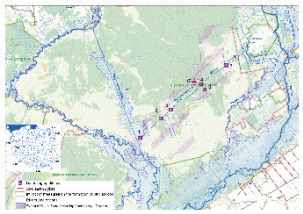
Subsoiling (Not defined)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6250

Subsoiling is defined as tillage below a depth of 14 inches, which does not invert soil. Subsoiling creates larger pores that increase rooting and infiltration.

Afforestation of reservoir catchments (F03 Afforestation of reservoir catchment)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6255

Afforestation of former fallow land to improve water storage and reducing nutrients leaching to nearby Głuszyński Lake.

Wetland restoration and management (N02 Wetland restoration and management)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6267



Building a permanent and regulated outflow through ditches and earth dykes on peatlands located in the Biebrza National Park, to restore optimal feeding conditions for the preservation of the Greater Spotted Eagle population by restoring and extending spring pluvial floods, stopping the deglaciation of peat soils and shrubs and maintaining open areas through mowing.

Buffer Zone (A02 Buffer strips and hedges)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5936

Green belts on the agriculture land along the rivers and creeks to reduce nutrient leaching to waters.

5 Austria / Slovenia – Pesnica

Low till agriculture (A07 Low till agriculture)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6241

Conservation tillage is tillage without the use of a plow, which means no tilting of the soil. In the case of conservation tillage after tillage and sowing, more than 30% of the cultivated area of the field remains covered with crop residues left over from the previous crop. Means minimum tillage for the main crop with trailed passive tillage machines (e.g. cultivator - cultivator, rotary harrows, combined tillage machines, etc.) and (or) with driven - active tillage machines (e.g. rotary harrow, rotary cultivator, digger, etc.) ", and plowing is not allowed.

Early sowing (A09 Early sowing)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6242

Early sowing refers to sowing up to six weeks before the usual sowing season. This allows for the earlier and faster establishment of winter plants that provide quick cover over the winter, and the development of a root network that leads to soil protection. The period in which the soil lies bare is shorter, so erosion and runoff are less pronounced and water infiltration is improved. Early sowing also helps mitigate the effects of summer drought on spring crops, especially extreme evapotranspiration rates in Mediterranean regions. However, early sown plants are susceptible to frost; therefore, farmers risk crop loss due to low temperatures.

Protective buffers along the streams (A02 Buffer strips and hedges)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6246

Stream buffers create space between the water and upland land uses. The wider the buffer, the more effectively it processes nutrients and slows sediments in runoff before they enter the stream. Recent studies recommend 100 feet as the minimum buffer width to improve wildlife habitat, water quality and storm resiliency.

Basins and Ponds (U11 Retention Ponds)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5933

Detention basins and ponds are water bodies storing surface run-off water. A detention basin is free from water in dry weather flow conditions, whereas a pond (e.g. retention ponds, flood storage reservoirs, shallow impoundments) contains water during dry weather, and is designed to hold more when it rains. Retention ponds are ponds or pools designed with additional storage capacity to attenuate surface runoff during rainfall events.

6 Slovenia / Hungary. - Kebele- Kobiljski potok

Land use change (F05 Land use conversion)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_2823

Technology is based on changing cropland to grazing land due to shallow soils with high share of rocks. This is the cause for lower yields or loss of yield during drought periods.

Crop rotation (A03 Crop rotation)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6239

The crop rotation is one of the basic measures in agricultural production and is a system of sorting various crops and vegetables in a certain area at a certain time. With the correct crop rotation, with the appropriate cultivation technique, we get closest to the biological balance of natural phytocenoses.

Green cover of arable land (A08 Green cover)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6238

After the harvest of the main crop, we are left with an empty stubble, which is exposed to the harmful effects of the environment. Therefore, it is recommended to sow the new plant as soon as possible after the main harvest. Timely sowing prevents the loss of capillary water from the soil and reduces the negative effects of summer weather conditions (heat, downpours). Before sowing the next »main« agricultural plant, the crop or crop residues must be tilled and use as »green manure«. With this technique, we can protect the soil from erosion and leaching, improve soil structure and improve fertility, increase organic matter in the soil, improve the air-water regime in the soil, reduce surface weeding, reduce fertilizer consumption and protects the soil from the harmful effects of the weather.

Dams and other longitudinal barriers (Not defined)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6247

A dam is a structure built across a river or stream to hold backwater. Ancient dam builders used natural materials such as rocks or clay. Modern-day dam builders often use concrete. Man-made dams create artificial lakes called reservoirs. Reservoirs can be used to store water for farming, industry, and household use.

7 Belgium - La Wimbe

Wetland (N02 Wetland restoration and management)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5926

This wetland is an upland depression that collect water, wherein the substrate is saturated with water and is covered by shallow water. The land supports predominantly hydrophytes such as reeds.

Buffer strips and hedges (A02 Buffer strips and hedges)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6162

Buffer strips and hedges are areas of natural vegetation cover (hedges, shrubs or trees) at the edge/margin of agricultural fields/parcels. They slow runoff, reduce erosion and filter pollutants from agricultural runoff.

Intermediate Nitrate Trapping Crops (A08 Green cover)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6159

A post-harvest intermediate crop is grown to trap nitrate and control agricultural nitrate leaching. This intermediate crop is sown in August, after the main crop, which will draw excess fertilizer present in the soil either coming from the previous crop or from the soil itself, thereby preventing the percolation of nitrate into groundwater during the winter.

Forest riparian buffers (F01 Forest riparian buffers)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6167

Riparian forest buffers are trees and shrubs planted adjacent to a stream, which filter nutrients, pesticides, sediment and animal waste from agricultural land runoff, stabilize river banks thereby reduce bank erosion, protects the river from nonpoint pollution and provide habitats for organisms.

Maintenance of forest cover in headwaters (F02 Maintenance of forest cover in headwater areas)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5925

Forests in headwater areas benefits water quality and the hydrologic cycling. Specifically, maintaining the forest cover in headwater catchments offers multiple benefits such as increase soil water retention, intercept pollution pathways, improve soil and absorb and retain carbon dioxide.

Wetland in Dotnuvėlė river basin (N01 Basins and ponds)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5996

The installation of this wetland contributes to reducing ecological debt to nature by restoring natural complexes, helping to carry out the necessary research, reaching a balance between environmental and economic interests, promoting sustainable farming conditions in one of the most important and valuable natural areas of central Lithuania.

9 Italy – Cherio

Crop rotations (A03 Crop rotation)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6251

Agronomic technique that consists in the cultivation of different crops or types of crops in the same area or parcel, either in sequential (a pre-defined rotation scheme may be adopted) or during the same cropping season.

Hillside terraces and hillside terraces with dry-stone walls (A10 Traditional terracing)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6252

Terraces consist in land arrangements obtained by levelling hilly parts or steep slopes, in most cases sustained by dry-stone walls. This allows controlling surface erosion and run-off, and gives the possibility to expand the cultivable land for either arable or permanent crops.

River bank stabilisation with natural materials (N10 Natural bank stabilisation)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6253

Natural vegetation, such as live vegetation (grass, shrubs, and trees) and woody material, can be newly implemented or used to replace pre-existing rigid structures, with the prime aims to stabilize riverbanks, reduce their erosion and restore the hydrological functionality of the river.

Water storage reservoirs (U10 Detention Basins)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6254

Especially in the urban environment the realization of artificial detention basins is aimed at receiving excess water during flood events, reducing the flood risk and eventually storing water to be used for specific purposes (e.g. irrigation in agricultural areas)

Water retention areas along the river (U10 Detention Basins)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5931

Uncultivated natural areas or artificially designed areas along the river that serve as floodplains to mitigate its flow during flooding events by temporarily storing part of the volume of the flood wave.

10 Norway – Hobøl

Reduced tillage - no tillage in autumn (A06 No till agriculture)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1245

Reduced tillage involves no plowing in the autumn, in order to preserve stubble or plant cover during the autumn and winter.

Grass covered buffer zones (A02 Buffer strips and hedges)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_1656

Establishment of grass covered vegetation strips along cropland waterways to reduce surface runoff of particles and nutrients and reduce erosion.

Grassed waterways (N05 Stream bed re-naturalization)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6169

Grassed waterways are shallow channels (natural or constructed) with a grass cover, used to drain surface runoff from cropland and prevent erosion.

Small constructed wetland (N01 Basins and ponds)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5940

Small constructed wetland is a combination of ponds and vegetation filters, designed mainly to remove sediment and nutrient from the streams. It is usually located in first- and second order streams in agricultural landscape.

Small retention pond in the forest (F09 Sediment capture ponds)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6156

Small retention ponds (located in the forest) are ponds or pools with additional storage capacity to attenuate surface runoff during rainfall events. The pond (e.g. retention ponds, flood storage reservoirs, shallow impediments) contains limited or no water during dry weather, and is designed to retain water during rain events.

Grass (or stubble) on areas prone to flooding and erosion risk (A08 Green cover)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6170

Establishment of grass (or keep stubble) on arable land that is prone to erosion and flooding to reduce the risk of soil and nutrient losses.

11 Hungary – Tetves

Sediment capture ponds (F09 Sediment capture ponds)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6196

Some sediment capture ponds are located throughout the catchment

Afforestation (F04 Targeted planting for 'catching' precipitation)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5930

Afforestation is one such land conversion in which trees are planted on previously non-forested areas.

Peak flow control structures (F13 Peak flow control structures)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6201

Reduced traffic (A11 Controlled traffic farming)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6202

Controlled traffic farming (CTF) is a system, which confines all machinery loads to the least possible area of permanent traffic lanes.

Buffer strips (A02 Buffer strips and hedges)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6203

Buffer strips are small areas or strips of land in permanent vegetation, designed to intercept pollutants and manage other environmental concerns.

Forest riparian buffers (F01 Forest riparian buffers)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6204

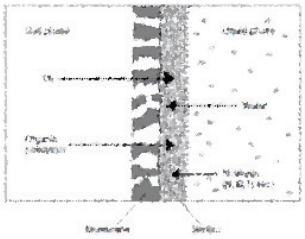
Treed areas alongside streams and other water bodies.

No till agriculture (A06 No till agriculture)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6199

No-till farming (also called zero tillage or direct drilling) is a way of growing crops or pasture from year to year without disturbing the soil through tillage.

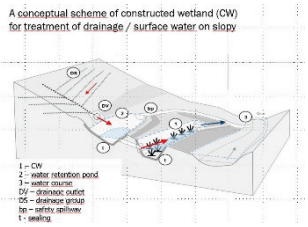
12 Czech Rep. – Čechtický

Biofilter – bioreactor (Not defined)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6259



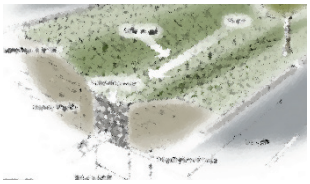
Pollution control technique using buried container with a bioreactor containing active material to capture and biologically degrade pollutants.

Constructed wetland on tile drainage (N02 Wetland restoration and management)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5939



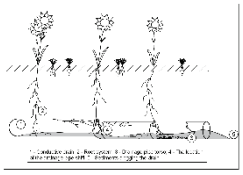
A combined retention wetland for retention and gradual outflow and remediation of drainage waters. Designed optionally with subsurface horizontal, vertical or combined flow. Substrate is a mixture of matuted (6 months) 4-30 mm birch chips and 4 – 8 mm gravel (1:10), planted with common reeds (Phalaris arundinacea) and read mannagrass (Glyceria maxima). The wetland is constructed to remove nitrogen and some pesticides from drainage waters.

Infiltration drain (N13 Restoration of natural infiltration to groundwater)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6183



Measure focused on the local enhancement of water infiltration process into the soil. Water from the subsurface (drainage) runoff is infiltrated through perforated pipes that are buried in the drainage trench - infiltration drain.

Controlled spontaneous aging of drainage systems (N13 Restoration of natural infiltration to groundwater)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6240



Letting drains to lose their functionality by aging (growing up by roots, fouling by sediments) movements of tiles.

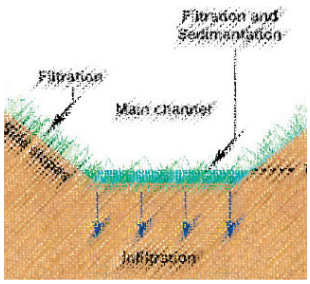
Grassing targeted into Recharge area (A01 Meadows and pastures)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5934

Grassing targeted into recharge (infiltration) areal of agricultural drainage system will significantly improve drainage water quality.

Grassed waterway (talweg) (N05 Stream bed re-naturalization)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6243

Grassing targeted into waterways (thalweg).

Retention swale (U04 Swales)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6244



The retention swale is a line element intended to capture surface runoff and convert it to infiltration. These elements are dimensioned for the total volume of runoff from the source area. It is not fortified in the bottom and slopes. Slopes of slopes should not exceed 1: 5, they are usually designed milder (e.g. 1:10) so that the clearance is passable or cultivable.

Direct seeding (A06 No till agriculture)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6245

When sowing cereals and / or oilseed rape using general soil protection technology, at least 30% of the soil cover with plant residues must be observed until the emergence of the stand, and after emergence it must be visually demonstrable that when planting other cereals and oilseed rape on fields endangered by erosion, general soil protection technology was used in the areas.

Water Level Adjustment Threshold (U10 Detention basins)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_5937

Water Level Adjustment Threshold will promote sedimentation in drainage ditches.

Phosphorus pond (N02 Wetland restoration and management)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6260

Wetlands/ponds are created to retain nutrients and prevent drought/flooding.

Riparian Buffer Zones (A02 Buffer strips and hedges)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6261

Riparian areas proximal to streams and ditches that are not in agricultural production can slow the movement of particulate matter and water from fields to receiving waters, thereby potentially limiting peak flow.

Two stage ditches (N03 Floodplain restoration and management)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6262

Drainage ditches with a "bench" or floodplain can slow the movement of water and retain nutrients, benches function as wetlands when wet.

3.3.3. NSWRM by NWRM category

The NWRM.eu catalogue currently contains 53 NWRM categories organised in the four sectors Agriculture, Forest, Urban, and Hydro morphology (see **Figure 1**). Out of these categories, 29 have been selected for OPTAIN (see chapter 2.1 and **Figure 5**). Each category includes 1-10 NSWRM examples that are being documented for OPTAINs catalogue of NSWRM and modelled during the OPTAIN project. Below we specify for each sector which measures will be addressed.

Agriculture:

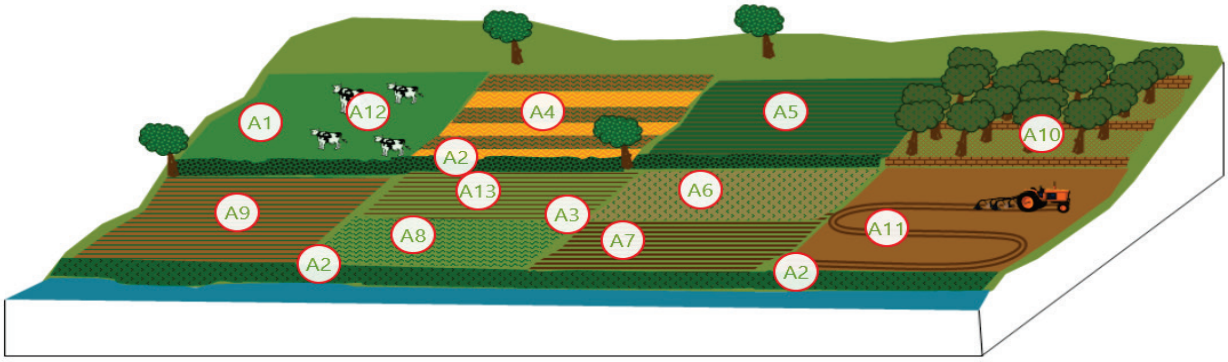


Figure 8: Agriculture NWRM Sector (Source: NWRM.eu)

A01: Meadows and pastures
http://nwrm.eu/measure/meadows-and-pastures

Meadows are areas or fields whose main vegetation is grass, or other non-woody plants, used for mowing and haying. Pastures are grassed or wooded areas, moorland or heathland, generally used for grazing. Due to their rooted soils and their permanent cover, meadows and pastures provide good conditions for the uptake and storage of water during temporary floods. They also protect water quality by trapping sediments and assimilating nutrients. The measure offers the potential for temporary flood storage, increased water retention in the landscape and runoff attenuation. Soil cover is maintained at all times with rooted vegetation, this reduces the surface flow of water and allows greater infiltration to the soil. Rates of soil erosion are considerably lower than arable land with potential benefits for water quality (NWRM, 2019).

Including the following NSWRM:

- **Meadows and pastures** (3b Hungary - Felso-Valicka)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6195
- **Grassing targeted into Recharge area** (12 Czech Rep. – Čechtický)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5934

A02 Buffer strips and hedges
http://nwrm.eu/measure/buffer-strips-and-hedges

Buffer strips are areas of natural vegetation cover (grass, bushes or trees) at the margin of fields, arable land, transport infrastructures and water courses. They can have several different configurations of vegetation found on them varying from simply grass to combinations of grass, trees, and shrubs. Due to their permanent vegetation, buffer strips offer good conditions for effective water infiltration and slowing surface flow; they therefore promote the natural retention of water. They can also significantly reduce the amount of suspended solids, nitrates and phosphates originating from agricultural run-off. Buffer strips can be sited in riparian zones, or away from water bodies as field margins, headlands or within fields (e.g. beetle banks). Hedges across long, steep slopes may reduce soil erosion as they intercept and slow surface run-off water before it builds into damaging flow, particularly where there is a margin or buffer strip alongside. For the purpose of this catalogue, riparian buffer (see F1) are considered a separate NWRM as they generally have different design, implementation and management criteria (NWRM, 2019).

Including the following NSWRM:

- **Hedgerows to subdivide larger fields** (1 Germany - Schwarzer Schöps)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6263
- **Edge-of-field filter/Flower strips** (1 Germany - Schwarzer Schöps)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6264
- **Grassed Riparian buffer strips** (1 Germany - Schwarzer Schöps)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6258
- **Riparian forest** (2 Switzerland - Petite Glâne)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6248/
- **Buffer Zone** (4 Poland - Upper Zglowiaczka)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5936
- **Protective buffers along the streams** (5 Austria / Slovenia – Pesnica)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6246/
- **Buffer strips and hedges** (7 Belgium - La Wimbe)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6162
- **Grass covered buffer zones** (10 Norway – Hobøl)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_1656
- **Buffer strips** (11 Hungary – Tetves)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6203
- **Riparian Buffer Zones** (14 Sweden - Sävjaån Headwaters)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6261

A03 Crop rotation
http://nwrm.eu/measure/crop-rotation

Crop rotation is the practice of growing a series of dissimilar/different types of crops in the same area in sequential seasons. Judiciously applied (i.e. selecting a suitable crop) crop rotation can improve soil structure and fertility by alternating deep-rooted and shallow-rooted plants. In turn, this can reduce erosion and increase infiltration capacity, thereby reducing downstream flood risk. It gives various benefits to the soil. A traditional element of crop rotation is the replenishment of nitrogen through the use of green manure in sequence with cereals and other crops. Crop rotation also mitigates the build-up of pathogens and pests that often occurs when one species is continuously cropped. However, as crop rotation has been traditionally practiced for agronomic reasons rather than to achieve environmental and water objectives, new practices may be required to ensure water retention benefits can be achieved. Some crops such as potatoes carry greater risks of erosion due to formation of ridges and the greater area of bare soil. Crop rotation can be used in combination with other measures when these are compatible with crop choice (NWRM, 2019).

Including the following NSWRM:

- Crop rotation (6 Slovenia / Hungary .- Kebele- Kobiljski potok)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6239
- Crop rotations (9 Italy – Cherio)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6251

A04 Strip cropping along contours

http://nwrm.eu/measure/strip-cropping-along-contours

Strip cropping is a method of farming used when a slope is too steep or too long, or otherwise, when one does not have an alternative method of preventing soil erosion. It alternates strips of closely sown crops such as hay, wheat, or other small grains with strips of row crops, such as corn, soybeans, cotton, or sugar beets. Strip cropping helps to stop soil erosion by creating natural dams for water, helping to preserve the strength of the soil. Certain layers of plants will absorb minerals and water from the soil more effectively than others. When water reaches the weaker soil that lacks the minerals needed to make it stronger, it normally washes it away. When strips of soil are strong enough to slow down water from moving through them, the weaker soil cannot wash away as it normally would. Because of this, farmland stays fertile much longer. There is no available information on the extent of strip cropping in Europe. The practice has been widespread in North America as a means of mitigating soil erosion from wind and water (NWRM, 2019).

Including the following NSWRM:

- **Maize strip tillage** (Switzerland - Petite Glâne)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_1008
- **Slope subdivision through a field seam** (Switzerland - Petite Glâne)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_1670

A05 Intercropping

http://nwrm.eu/measure/intercropping

Intercropping is the practice of growing two or more crops in proximity. The most common goal of intercropping is to produce a greater yield on a given piece of land by making use of resources that would otherwise not be utilised by a single crop. Examples of intercropping strategies are planting a deep-rooted crop with a shallow-rooted crop, or planting a tall crop with a shorter crop that requires partial shade. Numerous types of intercropping, all of which vary the temporal and spatial mixture to some degree, have been identified: mixed intercropping, row cropping, relay cropping, etc. (NWRM, 2019).

Including the following NSWRM:

- **Grain legumes intercropped with cereals & partners** (2 Switzerland - Petite Glâne) https://qcat.wocat.net/en/wocat/technologies/view/technologies_6235

A06 No till agriculture
http://nwrm.eu/measure/no-till-agriculture

Tillage is a mechanical modification of the soil. Intensive tillage can disturb the soil structure, thus increasing erosion, decreasing water retention capacity, reducing soil organic matter through the compaction and transformation of pores. No-till farming (also called zero tillage or direct drilling) is a way of growing crops or pasture from year to year without disturbing the soil through tillage. No-till is an agricultural technique, which increases the amount of water that infiltrates into the soil and increases organic matter retention and cycling of nutrients in the soil. In many agricultural regions, it can eliminate soil erosion. The most powerful benefit of no-tillage is improvement in soil biological fertility, making soils more resilient (NWRM, 2019).

Including the following NSWRM:

- **Direct seeding** (2 Switzerland - Petite Glâne)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_1007
- **Reduced tillage - no tillage in autumn** (10 Norway – Hobøl)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_1245
- **No till agriculture** (11 Hungary – Tetves)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6199
- **Direct seeding** (12 Czech Rep. – Čechtický)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6245

A07 Low till agriculture
http://nwrm.eu/measure/low-till-agriculture

Low till agriculture, also known as conservation or reduced till applies to arable land. It consists of a combination of a crop harvest which leaves at least 30% of crop residue on the soil surface, during the critical soil erosion period and some surface work (low till). This slows water movement, which reduces the amount of soil erosion and potentially leads to greater infiltration (NWRM, 2019).

Including the following NSWRM:

- **Conservation or low tillage** (1 Germany - Schwarzer Schöps)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6257
- **Low till agriculture** (5 Austria / Slovenia – Pesnica)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5494

A08 Green cover
http://nwrm.eu/measure/green-cover

Green cover (including cover crops or catch crops) refers to crops planted in late summer or autumn, usually on arable land, to protect the soil, which would otherwise lie bare during the winter, against wind and water erosion. Green cover crops also improve the structure of the soil, diversify the cropping system, and mitigate the loss of soluble nutrients (NWRM, 2019).

Including the following NSWRM:

- **Cover crops** (1 Germany - Schwarzer Schöps)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5929
- **Green cover in vineyard** (3a Hungary - Csorsza)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6194
- **Green cover of arable land** (6 Slovenia / Hungary .- Kebele- Kobiljski potok)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6238
- **Intermediate Nitrate Trapping Crops** (7 Belgium - La Wimbe)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6159
- **Grass (or stubble) on areas prone to flooding and erosion risk** (10 Norway – Hobøl)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6170

A09 Early sowing
http://nwrm.eu/measure/early-sowing

Early sowing refers to sowing up to six weeks before the normal sowing season. This allows for an earlier and quicker establishment of winter crops that can provide cover over winter and of a root network that leads to soil protection. The period in which the soil lies bare is shorter and, therefore, erosion and run-off are less significant and water infiltration is improved. Early sowing can also help to mitigate summer drought impacts on spring sown crops, in particular the extreme evapotranspiration rates of Mediterranean regions. However, early sown plants are frost sensitive; therefore farmers run the risk of losing the crops because of the low temperatures. In northern countries, temperature in spring (March) can be adequate but the risk of frost is still serious until May. The low temperatures in northern countries may also delay crop establishment in spring crops resulting in an increased risk of soil erosion, avoiding cultivation and retaining residues from preceding crops may be preferable. Therefore, early sowing may require specific tools (plastic tunnel covers, onsite green house, etc.) and cannot be applied by all farmers for all crops. Early sowing of spring crops may also require different cultivation techniques (reduced tillage, controlled traffic farming) as soils are likely to be saturated before usual sowing times increasing the risk of soil compaction. Restrictions on early sowing of winter crops include the harvest date of the preceding crop (particularly root crops) which may be later in northern Europe. For both spring and winter crops, early sowing involves a number of trade-offs. For example, different pest and disease risks arise that might require changes in management (NWRM, 2019).

Including the following NSWRM:

- Early sowing (5 Austria / Slovenia – Pesnica)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6242/

A10 Traditional terracing
http://nwrm.eu/measure/traditional-terracing

Traditional terraces consist of nearly level platforms built along contour lines of slopes, mostly sustained by stone walls, used for farming on hilly terrain. By reducing the effective slope of land, terracing can reduce erosion and surface run-off by slowing rainwater to a non-erosive velocity. This also increases the degree if infiltration and improves soil moisture. However, abandonment of traditional terracing can result in high levels of erosion and run-off due to the lack of maintenance of stone walls. Abandonment can also change the nature of local flora and fauna; this may not be beneficial, for example, the spontaneous regeneration of vegetation can present a risk of wild fire spread on sloping land.

This measure focuses on existing or traditional terracing as it involves less disturbance of the terrain than modern terracing such as significant levelling or cutting using heavy machinery. As the measure is highly labour intensive and costly to implement the focus of the measure would be in maintaining existing terracing rather than expansion (NWRM, 2019).

Including the following NSWRM:

- **Hillside terraces and hillside terraces with dry-stone walls** (9 Italy – Cherio)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6252/

A11 Controlled traffic farming
http://nwrm.eu/measure/controlled-traffic-farming

Controlled traffic farming (CTF) is a system, which confines all machinery loads to the least possible area of permanent traffic lanes. Current farming systems allow machines to run at random over the land, compacting around 75% of the area within one season and at least the whole area by the second season. Soils do not recover quickly, taking as much as a few years. A proper CTF system on the other hand can reduce tracking to just 15% and this is always in the same place. CTF is a tool; it does not include a prescription for tillage although most growers adopting CTF use little or none because soil structure does not need to be repaired. The permanent traffic lanes are normally parallel to each other and this is the most efficient way of achieving CTF, but the definition does not preclude tracking at an angle. The permanent traffic lanes may be cropped or non-cropped depending on a wide range of variables and local constraints (NWRM, 2019).

Including the following NSWRM:

- **Reduced traffic** (11 Hungary – Tetves)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6202

A13 Mulching
http://nwrm.eu/measure/mulching

A mulch is a layer of material applied to the surface of an area of soil. Its purpose is any or all of the following:

- to conserve moisture
- to improve the fertility and health of the soil
- to reduce weed growth
- to enhance the visual appeal of the area

Mulching as NWRM is using organic material (e.g. bark, wood chips, grape pulp, shell nuts, green waste, leftover crops, compost, manure, straw, dry grass, leaves etc.) to cover the surface of the soil. It may be applied to bare soil, or around existing plants. Mulches of manure or compost will be incorporated naturally into the soil by the activity of worms and other organisms. The process is used both in commercial crop production and in gardening, and when applied correctly can dramatically improve the capacity of soil to store water (NWRM, 2019).

Including the following NSWRM:

- **Mulching** (4 Poland - Upper Zglowiaczka)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6249/

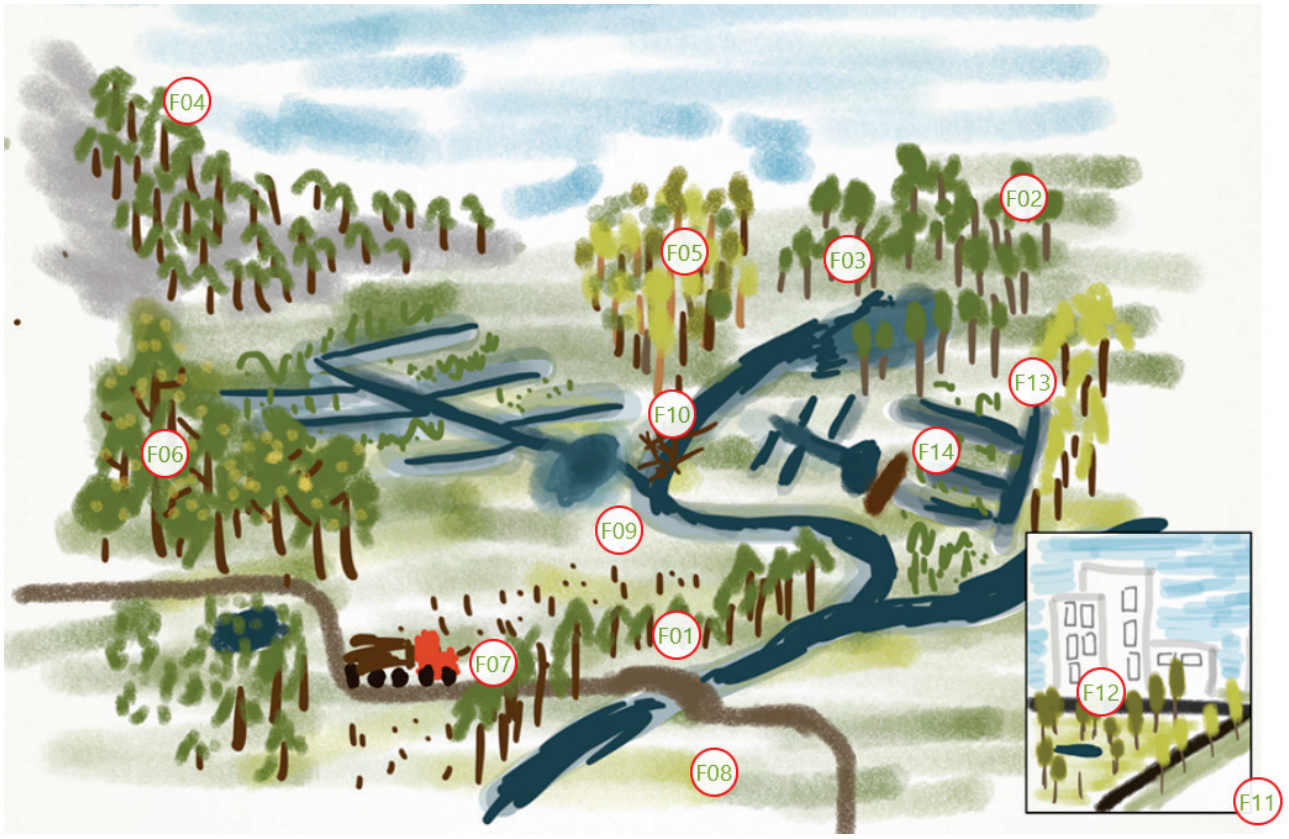


Figure 9: Forest NWRM Sector (Source: NWRM.eu)

F01 Forest riparian buffers

http://nwrm.eu/measure/forest-riparian-buffers

Riparian buffers are treed areas alongside streams and other water bodies. While most commonly associated with set asides following forest harvest, riparian buffers can also be found in urban, agricultural and wetland areas. By preserving a relatively undisturbed area adjacent to open water, riparian buffers can serve a number of functions related to water quality and flow moderation. The trees in riparian areas can efficiently take up excess nutrients and may serve to increase infiltration. Riparian buffers serve to slow water as it moves off the land. This can decrease sediment inputs to surface waters (NWRM, 2019).

Including the following NSWRM:

- **Forest riparian buffers** (7 Belgium - La Wimbe)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6167
- **Forest riparian buffers** (11 Hungary – Tetves)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6204

F02 Maintenance of forest cover in headwater areas
http://nwrm.eu/measure/maintenance-forest-cover-headwater-areas

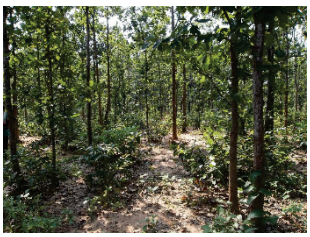
Headwaters are the source areas for rivers and streams, crucial for sustaining the structure, function, productivity and complexity of downstream ecosystems. They are vital to hydrologic cycling as they are one of the main areas where precipitation contributes to surface and groundwater. Headwaters are typically less intensively used than downstream areas. In many headwater areas, extensive agriculture, forests or other semi-natural land cover types predominate. Forests in headwater areas have a beneficial role for water quantity and quality. Creating or maintaining forest cover in headwater catchments is a widely used practice in many major cities including New York, Istanbul and Singapore, as these cities are reliant on headwater forests for drinking water provisioning. Forest soils generally have better infiltration capacity than other land cover types and may act as a "sponge", slowly releasing rainfall. In areas of high relief, afforestation of headwater catchments can contribute to slope stabilization and may reduce the risks associated with landslides. On the other hand, afforestation of headwaters in dry areas may lead to reduction of water yield (NWRM, 2019).

Including the following NSWRM:

- Maintenance of forest cover in headwaters (7 Belgium - La Wimbe)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5925

F03 Afforestation of reservoir catchment

http://nwrm.eu/measure/afforestation-reservoir-catchments

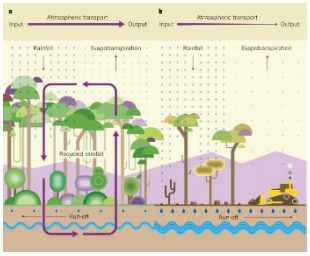


Planting trees in reservoir catchments can have both negative and positive effects. . Afforestation of previously bare or heavily eroded areas can control soil erosion, thereby extending the life of the reservoir and improving water quality. Water quality can also be improved if precipitation is able to infiltrate into forest soils before flowing to the reservoir. These potential improvements in water quality need to be balanced against the possibility that less precipitation will be available for reservoir recharge due to the potentially greater interception and evapotranspiration associated with forests. Studies have indicated decrease of water yield after afforestation of the catchment and with the increase of forest age. Forests in reservoir catchments should typically not be managed for timber production, but maintained in as close to a natural state as possible as the fertilization and ground disturbance associated with intensive forest management can have negative impacts on reservoir water quality. Increased acidification and eutrophication after afforestation with conifer species have also been reported. Use of long-lived native deciduous tree species for afforestation instead of fast growing conifers or eucalypts is likely to bring enhanced biodiversity benefits while minimizing water loss (NWRM, 2019).

Including the following NSWRM:

- **Afforestation of reservoir catchments** (4 Poland - Upper Zglowiaczka)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6255

F04 Targeted planting for 'catching' precipitation
http://nwrm.eu/measure/targeted-planting-catching-precipitation



There is some evidence to suggest that loss of tree cover on Mediterranean hill slopes has altered weather patterns, which in turn have altered precipitation amount and timing. Modelling results suggest that Mediterranean precipitation regimes are very sensitive to variations in air temperature and moisture. Land use change and associated deforestation may have led to changes from and open monsoon-type regime with frequent summer storms over inland mountains to a regime dominated by closed vertical atmospheric recirculation where feedback mechanisms suppress storms over the coastal mountains and lead to increased summer time sea surface warming. This warming leads to torrential rains in autumn and winter. These rains can occur across the Mediterranean basin. This can be exacerbated by greenhouse heating associated with air pollutants. Targeted afforestation in some parts of the Mediterranean may be one means of combating drought and desertification. However, caution should be taken when choosing areas for afforestation to avoid possible adverse effects, as there is some evidence that afforestation in dry environments, especially in montane areas, may decrease water yield and cause water deficit in the downstream rivers. Local tree species should be used to reduce risks to biodiversity (NWRM, 2019).

Including the following NSWRM:

- **Afforestation** (11 Hungary – Tetves)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5930

F05 Land use conversion
http://nwrm.eu/measure/land-use-conversion

Land use conversion is a general term for large-scale geographic change. Afforestation is one such land conversion in which trees are planted on previously non-forested areas. Afforestation may occur deliberately or through the abandonment of marginal agricultural land. Depending on the tree species planted and the intensity of forest management, afforestation may have more or less environmental benefits. The NWRM related benefits include potentially enhanced evapotranspiration associated with growing forests and better water holding capacity associated with forest soils. The greatest environmental benefits are probably associated with planting of indigenous broadleaves and low intensity forestry. Plantation forestry with exotic species is likely to be less beneficial to the environment. It should be mentioned that afforestation in dry areas can cause or intensify water shortage. Even though afforestation may reduce available water supply at local scale, forest cover increases water supply regionally and globally, in particular through the intensification of the water cycle (NWRM, 2019).

Including the following NSWRM:

- **Land use change** (3b Hungary - Felso-Valicka)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6198

- **Land use change** (6 Slovenia / Hungary .- Kebele- Kobiljski potok
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_2823

F09 Sediment capture ponds

http://nwrm.eu/measure/sediment-capture-ponds

Sediment capture ponds are engineered ponds placed in networks of forest ditches to slow the velocity of water and cause the deposition of suspended materials. Sediment capture ponds are most useful for managing the effects of ditch construction and maintenance, roadwork and final feeling. While used primarily in forests, sediment capture ponds may be a useful temporary measure for preserving water quality in and around construction sites or mines. They may also be useful for capturing sediment in agricultural runoff. Sediment capture ponds have a limited lifespan, depending on how much suspended material is in the inflowing water. However, ponds can be maintained by removal of accumulated sediment. As most water protection methods, sediment capture ponds function well during base and moderate flow events. Catchment area, hydraulic properties of ditches, discharge rate and soil characteristics are among factors influencing functioning of sedimentation capture ponds. Effective functioning largely depends also on expertise and skill of professionals designing and implementing this and also many other measures (NWRM, 2019).

Including the following NSWRM:

- **Small retention pond in the forest** (10 Norway – Hobøl)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6156
- **Sediment capture ponds** (11 Hungary – Tetves)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6196

F10 Coarse woody debris
http://nwrm.eu/measure/coarse-woody-debris

Coarse woody debris in stream channels has multiple ecological and hydrologic benefits. Coarse woody debris consists of large sections of deadfall: tree stems or stumps that either fall into or are deliberately placed in streams. Coarse woody debris can be deployed with varying degrees of naturalness. At one extreme, coarse woody debris can be used to form coffer or placer dams, which effectively limit water flow. At the other extreme, natural deadfall coarse woody debris is found when riparian trees are allowed to fall naturally into streams. Coarse woody debris will generally slow water flow velocity and can reduce the peak of flood hydrographs. In addition to its role in slowing streamflow and facilitating sediment accumulation, coarse woody debris can improve aquatic biodiversity by retaining food and providing additional habitat, such as refuges and spawning sites (NWRM, 2019).

Including the following NSWRM:

- **Coarse woody debris** (3a Hungary - Csorsza)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6197

F13 Peak flow control structures

http://nwrm.eu/measure/peak-flow-control-structures

Peak flow control structures are designed to reduce flow velocities in networks of forest ditches. Peak flow control structures are engineered ponds designed to limit the rate at which water flows out of a ditch network. Because the structures slow water flow, they will contribute to sediment control and can reduce the size of flood peaks. Peak flow control structures will have a limited lifespan, as sediment will eventually fill in the upstream detention pond. However, ponds can be maintained by removal of accumulated sediment (NWRM, 2019).

Including the following NSWRM:

- **Peak flow control structures** (11 Hungary – Tetves)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6201

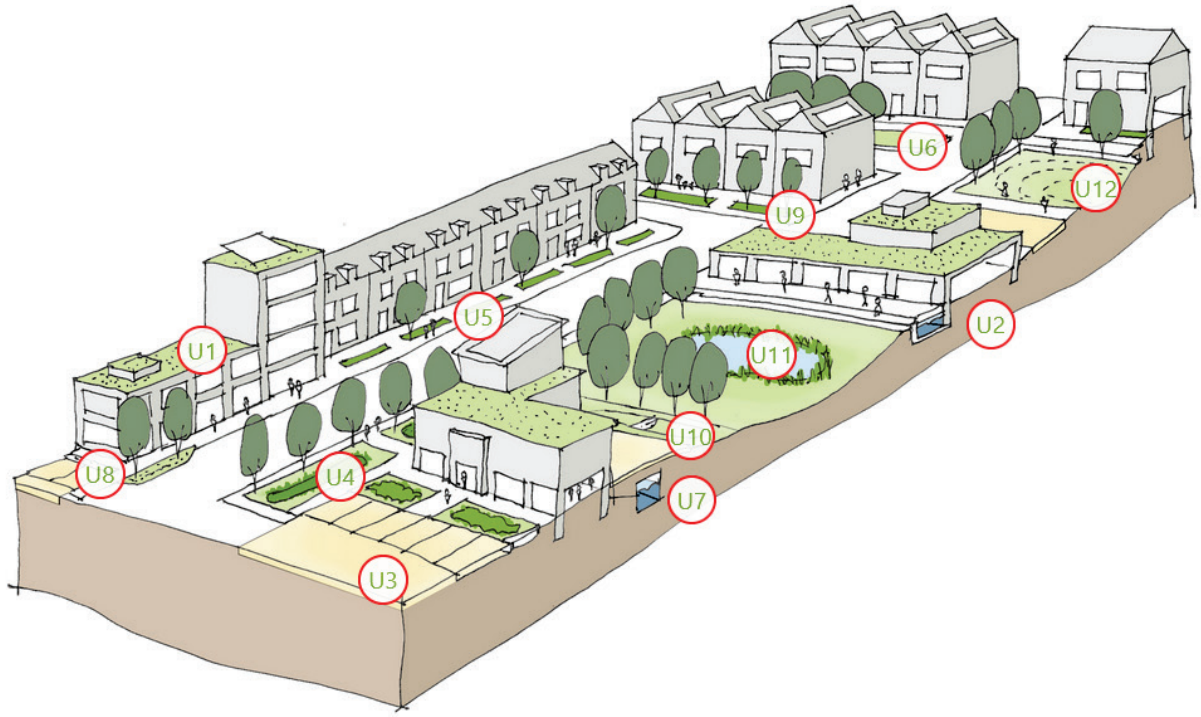


Figure 10: Urban NWRM Sector (Source: NWRM.eu)

U04 Swales

http://nwrm.eu/measure/swales

Swales are broad, shallow, linear vegetated channels, which can store or convey surface water (reducing runoff rates and volumes) and remove pollutants. They can be used as conveyance features to pass the runoff to the next stage of the SuDS treatment train and can be designed to promote infiltration where soil and groundwater conditions allow. Three kinds of swale give different surface water management capabilities:

Standard conveyance swale – Generally used to convey runoff from the drainage catchment to another stage of a SuDS train. They may be lined or un-lined, depending on the suitability for infiltration.

Enhanced dry swale – Includes an underdrain filter bed of soil beneath the vegetated conveyance channel to accommodate extra treatment and conveyance capacity above that of the standard swale. The underdrain leaves the main channel dry except for larger runoff events, and will prevent channels becoming waterlogged where the swale is

situated on gentler slopes. A lining can also be incorporated into the underdrain if infiltration to underlying ground is not appropriate.

Wet swale - Where prolonged treatment processes are required for the storm runoff, the swale's conveyance channel can be encouraged to maintain marshy conditions by using liners to control infiltration, or by siting in an area with high water table.

The promotion of settling is enhanced by the use of dense vegetation, usually grass, which promotes low flow velocities to trap particulate pollutants. In addition, check dams or berms can be installed across the swale channel to promote settling and infiltration. As a result, swales are effective in improving water quality of runoff, by removing sediment and particulate pollutants. In wet swales, the effectiveness is further enhanced by providing permanent wetland conditions on the base of the swale.

Swales are applicable to a wide range of situations. They are typically located next to roads, where they replace conventional gullies and drainage pipe systems, but examples can also be seen of swales being located in landscaped areas, adjacent to car parks, alongside fields, and in other open spaces. They are ideal for use as drainage systems on industrial sites because any pollution that occurs is visible and can be dealt with before it causes damage to the receiving watercourse (NWRM, 2019).

Including the following NSWRM:

- Grassed waterways (1 Germany - Schwarzer Schöps)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5935
- Retention swale (12 Czech Rep. – Čechtický)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6244

U10 Detention Basins
http://nwrm.eu/measure/detention-basins

Detention basins are vegetated depressions designed to hold runoff from impermeable surfaces and allow the settling of sediments and associated pollutants. Stored water may be slowly drained to a nearby watercourse, using an outlet control structure to control the flow rate. Detention basins do not generally allow infiltration: see U12 for infiltration basins. Detention basins can provide water quality benefits through physical filtration to remove solids/trap sediment, adsorption to the surrounding soil or biochemical degradation of pollutants. Detention basins are landscaped areas that are dry except in periods of heavy rainfall, and may serve other functions (e.g. recreation), hence have the potential to provide ancillary amenity benefits. They are ideal for use as playing fields, recreational areas or public open space. They can be planted with trees, shrubs and other plants, improving their visual appearance and providing habitats for wildlife (NWRM, 2019).

Including the following NSWRM:

- **Water storage reservoirs** (9 Italy – Cherio)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6254
- **Water retention areas along the river** (9 Italy – Cherio)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5931
- **Water Level Adjustment Threshold** (13 Latvia – Deviete)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5937

U11 Retention Ponds
http://nwrm.eu/measure/retention-ponds

Retention ponds are ponds or pools designed with additional storage capacity to attenuate surface runoff during rainfall events. They consist of a permanent pond area with landscaped banks and surroundings to provide additional storage capacity during rainfall events. They are created by using an existing natural depression, by excavating a new depression, or by constructing embankments. Existing natural water bodies should not be used due to the risk that pollution events and poorer water quality might disturb/damage the natural ecology of the system. Retention ponds can provide both storm water attenuation and water quality treatment by providing additional storage capacity to retain runoff and release this at a controlled rate. Ponds can be designed to control runoff from all storms by storing surface drainage and releasing it slowly once the risk of flooding has passed. Runoff from each rain event is detained and treated in the pond. The retention time and still water promotes pollutant removal through sedimentation, while aquatic vegetation and biological uptake mechanisms offer additional treatment. Retention ponds have good capacity to remove urban pollutants and improve the quality of surface runoff.

Ponds should contain the following zones:

- a sediment forebay or other form of upstream pre-treatment system (i.e. as part of an upstream management train of sustainable drainage components)
- a permanent pool which will remain wet throughout the year and is the main treatment zone
- a temporary storage volume for flood attenuation, created through landscaped banks to the permanent pool
- a shallow zone or aquatic bench, which is a shallow area along the edge of the permanent pool to support wetland planting, providing ecology, amenity and safety benefits.
- Additional pond design features should include an emergency spillway for safe overflow when storage capacity is exceeded, maintenance access, a safety bench, and appropriate landscaping. Well-designed and maintained ponds can offer aesthetic, amenity and ecological benefits to the urban landscape, particularly as part of public open spaces. They are designed to support emergent and submerged aquatic vegetation along their shoreline. They can be effectively incorporated into parks through good landscape design (NWRM, 2019).

Including the following NSWRM:

- **Basins and Ponds** (5 Austria / Slovenia – Pesnica)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5933

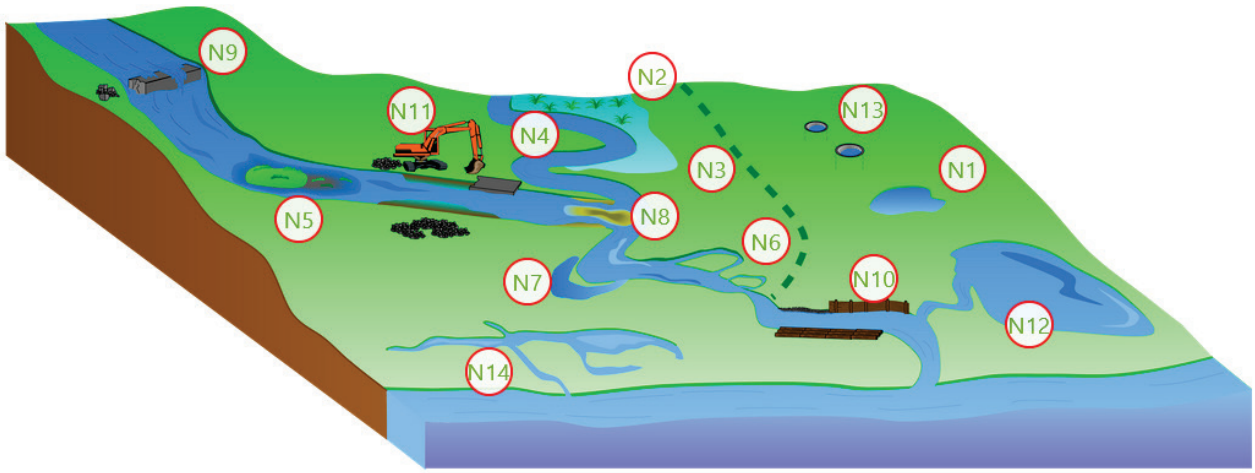


Figure 11: Hydro Morphology NWRM Sector (Source: NWRM.eu)

N01 Basins and ponds
http://nwrm.eu/measure/basins-and-ponds

Detention basins and ponds are water bodies storing surface run-off. A detention basin is free from water in dry weather flow conditions, whereas a pond (e.g. retention ponds, flood storage reservoirs, shallow impoundments) contains water during dry weather, and is designed to hold more when it rains (NWRM, 2019).

Including the following NSWRM:

- **Retention or detention ponds** (1 Germany - Schwarzer Schöps)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6265
- **Wetland in Dotnuvėlė river basin** (8 Lithuania – Dotnuvele)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5996
- **Small constructed wetland** (10 Norway – Hobøl)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5940

N02 Wetland restoration and management
http://nwrm.eu/measure/wetland-restoration-and-management

According to the Convention on Wetlands (1971), a wetland is an area of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres. It provides water retention, biodiversity enhancement or water quality improvement. Wetland restoration and management can involve: technical, spatially large-scale measures (including the installation of ditches for rewetting or the cutback of dykes to enable flooding); technical small-scale measures such as clearing trees; changes in land-use and agricultural measures, such as adapting cultivation practices in wetland areas. They can improve the hydrological regime of degraded wetlands and generally enhance habitat quality. Creating artificial or constructed wetlands in urban areas can also contribute to flood attenuation, water quality improvement and habitat and landscape enhancement (NWRM, 2019).

Including the following NSWRM:

- **Wetland restoration and management** (4 Poland - Upper Zglowiaczka)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6267
- **Wetland** (7 Belgium - La Wimbe)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5926
- **Constructed wetland on tile drainage** (12 Czech Rep. – Čechtický)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_5939
- **Phosphorus pond** (14 Sweden - Sävjaån Headwaters)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6260

N03 Floodplain restoration and management
http://nwrm.eu/measure/floodplain-restoration-and-management

A floodplain is the area bordering a river that naturally provides space for the retention of flood and rainwater. Floodplain soils are generally very fertile and they have often been dried-out to be used as agricultural land. Floodplains in many places have also been separated from the river by dikes, berms or other structures designed to control the flow of the river. They have also been covered by legacy sediments. Major floodplains roles have thus been lost, due to land drainage, intensive urbanization and river channelization. The objective is to restore them, their retention capacity and ecosystem functions, by reconnecting them to the river (NWRM, 2019).

Including the following NSWRM:

- **Two stage ditches** (14 Sweden - Sävjaån Headwaters)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6262

N05 Stream bed re-naturalisation
http://nwrm.eu/measure/stream-bed-re-naturalization

Streambed (or riverbed) represents the floor of the river, including each riverbank. In the past, riverbeds were artificially reconstructed with concrete or big stones, therefore modifying flows and decreasing fauna habitat and vegetation diversity. Those modifications were aiming at flood prevention or supporting changes of agricultural practices for example. This has led to uniformed flows in the rivers and often having effect of reducing travel time along the river. Streambed re-naturalization consists in removing some concrete or inert constructions in the riverbed and on riverbanks, then replacing them with vegetation structures, in order to avoid these damages and restore biodiversity.

The re-naturalization of riverbeds and banks could have a high impact on the erosion process. Stabilisation techniques are among the main measures to be implemented. The maximum impact is reached when the stabilisation technique restores the vegetation cover and the naturalness of the banks. Most of the time, techniques use plants for bank stabilization (NWRM, 2019).

Including the following NSWRM:

- **Grassed waterways** (10 Norway – Hobøl)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6169
- **Grassed waterway (talweg)** (12 Czech Rep. – Čechtický)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6243

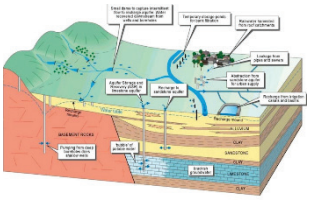
N10 Natural bank stabilisation
http://nwrm.eu/measure/natural-bank-stabilisation

Riverbank represents both natural and artificial terrain following the river flow. In the past, many artificial banks were built with concrete or other types of retention walls, therefore limiting rivers' natural movements, leading to degradation of the river, increased water flow, increased erosion and decreased biodiversity. River bank renaturalisation consists in recovering its ecological components, thus reversing such damages and especially allowing bank to be stabilized, as well as rivers to move more freely. Nature-based solutions such as bioengineering are preferable, but civil engineering has to be used in case of strong hydrological constraints (NWRM, 2019).

Including the following NSWRM:

- **River bank stabilisation with natural materials** (9 Italy – Cherio)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6253

N13 Restoration of natural infiltration to groundwater
http://nwrm.eu/measure/restoration-natural-infiltration-groundwater



Groundwater is the part of infiltrated water, which composes the water resource for population and human activities. Previous modifications of the landscape have reduced the infiltration capacity of many European soils, thereby limiting the rate at which precipitation is able to infiltrate and recharge groundwater aquifers. Restoration of natural infiltration to groundwater enables a lowering of run-off from surrounding land, and enhances the condition of groundwater aquifers and water availability. The natural cleaning processes associated with infiltration can improve water quality. This measure can also be known as "Artificial Groundwater Recharge" in the engineering literature.

Mechanisms to restore or enhance natural infiltration capacity include:

- surface structures to facilitate/augment recharge (such as soakaways and infiltration basins);
- subsurface indirect recharge – infiltration capacity is enhanced through wells drilled within the unsaturated zone; and
- subsurface direct recharge – infiltration and recharge of the groundwater aquifer is accomplished through wells reaching the saturated zone (NWRM, 2019).

Including the following NSWRM:

- Infiltration drain (12 Czech Rep. – Čechtický)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6183
- Controlled spontaneous aging of drainage systems (12 Czech Rep. – Čechtický)
  https://qcat.wocat.net/en/wocat/technologies/view/technologies_6240

Not defined as NWRM

A set of identified NSWRM could not be linked to existing NWRM categories, either because they have not been identified previously as having water retention capacity (deep ploughing, land use change) or because they do not have significant impact on water, soil or nutrient retention (drought resistant plants, biofilter).

Drought-resistant plants (Switzerland - Petite Glâne)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6272/

Development of new plant varieties that offer benefits such as improved production and drought tolerance, in response to changing environmental conditions.

Subsoiling (4 Poland - Upper Zglowiaczka)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6250
Ploughing is the basic cultivation procedure restoring soil production efficiency. It consists in a partial or total cut off from the cane of the role belt and then reversed and crushed. Deep ploughing - 20-35 cm (pre-winter ploughing). The purpose of deep ploughing is primarily to improve the soil structure, give it the efficiency, and accumulate the maximum amount of water from precipitation. Deep ploughing significantly reduces the population of pests, diseases and weeds. The plough sole is the result of compaction of the arable layer by passing machines, but mainly ploughing at a constant depth. The sole is a barrier to the roots of many crops and a deep chilled frog can solve this problem. Maybe, provided that the profile is deep enough and we will not cause this operation to draw the sterile soil necrosis on top. Compaction adversely affects air-water relations, clogging capillaries and reducing the amount of water available. The plough sole is characterised by lower air permeability, permeability and water capacity than the arable layer and deeper soil profile layers.

Land use change (6 Slovenia / Hungary. - Kebele- Kobiljski potok
https://qcat.wocat.net/en/wocat/technologies/view/technologies_2823

Land use change (arable land-grass, arable land-forest, arable land-wetland conversion)

Biofilter – bioreactor (12 Czech Rep. – Čechtický)
https://qcat.wocat.net/en/wocat/technologies/view/technologies_6259

Pollution control technique using buried container with a bioreactor containing active material to capture and biologically degrade pollutants.

4. Final statement /Outlook

The catalogue of NSWRM is a key product/output of OPTAIN and will be embedded in the Learning Environment (see Figure 6). The NSWRM factsheets, which are populated directly by case study implementers, are the main basis of the catalogue. This allows guaranteeing a high quality and a detailed set of information. On this basis, the Learning Environment can query the factsheets on a wide diversity of information and propose different outputs like ranges, illustrations, summary tables and graphs, which will serve to inform the end-users with pre-developed outputs, but also allows the end-users to elaborate their own view. Additional information can be collected and added to the catalogue with the WOCAT internal modules, such as an assessment of the greenhouse gas balance of different measures or an assessment if the measures can be further adapted to gradual climate changes and climate-related extremes. These additional information will be collected as soon the relevant specific NSWRM are documented and published on the WOCAT database.

The use of the Learning Environment is a challenge, as it requires clear and concise description of the end-users needs, and availability of the required data as well as references to develop standard presentation of the results. From the beginning, it has to be thought of in a flexible and customisable way to ensure its dissemination and use by a diverse community.

5. References

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6. Annexes

Annex 1: Guidelines for first (physical) MARG Meeting

OPTAIN WP2 Project Guidelines
WP2 Component for 1st MARG Workshop

Participatory identification of NSWRMs

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Foreword

These guidelines are based on broader methodology developed by the Centre for Development and Environment (CDE), University of Bern, Switzerland, as part of the EU FP6 project **DESIRE** (Schwilch *et al.*, 2008)**.**
https://www.wocat.net/en/projects-and-countries/projects/desire-desertification-mitigation-and-remediation-land-global-approach-local-solutions

In collaboration between CDE and ISRIC-World Soil Information (Wageningen, the Netherlands) the DESIRE guidelines have already been modified to suit the needs of the EU FP7 project **RECARE** (Caspari *et al.*, 2014).
https://www.recare-hub.eu

This guideline has been useful in the above mentioned project and it was decided to follow a similar approach for the OPTAIN project.

For **OPTAIN**, selected chapters of the modified version have been shortened and adapted to serve the project's objectives. Moreover, this version intends to guide the 14 case study leaders during the 1st multi-actor reference groups (MARG) workshop where existing and potentially suitable Natural/Small Water Retention Measures (NSWRMs) are being identified, discussed and selected.

- ⇨ The corresponding original DESIRE guidelines from Schwilch et al. (2014) are available at https://boris.unibe.ch/70305/
- ⇨ The corresponding adapted RECARE guidelines from Caspari et al. (2014) are available at http://www.recare-hub.eu/tools-and-outputs/project-reports

Table of Contents

Introduction

Stakeholder involvement in OPTAIN

The integrated, transdisciplinary approach of the OPTAIN project aims at initiating a process of co-production of knowledge and joint learning between relevant stakeholders from the local to the (sub-) national level. Thus, in each case study site a range of different stakeholders - from land users, civil society organizations, local authorities to industry and government representatives - will actively be engaged in the process (van den Brink et al 2021a).

The basis of the transdisciplinary approach of the OPTAIN project is a series of participatory stakeholder workshops to be carried out in all 14 case study areas.

For a flowchart and indicative timeline of stakeholder involvement in OPTAIN, see OPTAIN D1.1

WP2's particular interest lays in the **1st and 2nd MARG meetings/workshops,** where we aim at collecting missing information and discussing practicalities connected to existing (and potential) measures in case studies areas:

- MARG workshop 1: Identification of current / potential measures
- MARG workshop 2: Detailed discussion about measures, indicators and scenarios.

In order to help Case Study leaders and/or MARG leaders, WP2 will prepare detailed methodological guidelines for each of the two workshops we are involved in.

The present guidelines are intended for use in the 1st MARG workshop.

Stakeholder Workshops

General information

The workshops are a cornerstone of stakeholder participation and aim at enabling transdisciplinary learning processes throughout the project, i.e. learning processes between scientific and non-scientific actors. Thus, the workshops provide opportunities to initiate, promote and deepen a mutual learning process between the researchers and a range of relevant stakeholders (e.g. land managers, food producers, developers, industry, regulators, advisory services, authorities, experts) that have some kind of interest in the topic of soil threats and water and nutrient cycles in the case study sites. Each of the stakeholders - representing science, practice or policy making - have their own perspectives and will contribute to the intended dialogue and process of knowledge exchange and learning with their own expertise and experience (Schwilch *et al.*, 2009). Given that the knowledge contributed by scientific and non-scientific actors is valued equally in this process, and that local and scientific knowledge can be integrated to some extent, it is expected that more sustainable solutions can be identified and implemented. Workshop participants are expected to engage in a dialogue by sharing their knowledge and experience in regard to the soil threats and current water and nutrient losses or potential for retention/reuse, and by contributing to a joint reflection, decision-making and evaluation process in regard to mitigation and remediation measures.

Practical hints for organizing stakeholder workshops

(Caspari et al., 2014) adapted for OPTAIN workshop needs

Check out the OPTAIN MARG workshop report (D1.2) on how to facilitate for meaningful engagement in the MARG – issues for consideration: Page 11 and slides 85/103

- **Scheduling**: The timing of workshops is determined primarily by the availability of the participants, particularly land users, which means considering the agricultural calendar!
- **Location**: maximize participation by locating workshops in places that make attendance easy. It is strongly recommended to conduct the workshops inside the case study area. Experience shows that it is much easier to create a relaxed and trustful working atmosphere if the workshop takes place in the community itself, where local participants feel at home.
- **Venue:** Avoid very formal meeting places such as rooms from the local administration or classrooms with unmovable furniture, as people may feel less at ease and doing group work might be hampered by the lack of flexibility. Collaborative learning requires a flexible environment, where people can sit together and talk instead of classroom teaching arrangements. Working directly in the field (e.g. transect walk) usually opens up the minds of everybody, and makes local people feel that the discussions really touch on their reality and their concerns!
- **Meals**: Sharing meals promote informal contacts among different stakeholders, and are a central aspect of mutual experience.

Inform yourself about the current local COVID-19 regulations and select the location and the number of participants accordingly.

Selecting workshop participants – 1st MARG workshop

(Caspari et al., 2014) adapted for OPTAIN workshop needs

The general objectives of all stakeholder workshops are: 1) To strengthen trust and collaboration among concerned stakeholders, and 2) to enable and foster a mutual learning process among scientific and non-scientific stakeholders (among them local land users as well as researchers, representatives of the local administration, NGOs, GOs etc.). The learning process is characterized by creating a common understanding of problems, potentials and opportunities through integration of the perceptions and knowledge of all stakeholders involved, in order to identify possible solutions to the soil threats (Schwilch et al 2009). Thus, sharing one's knowledge and experience, joint reflection and dialogue, and co-creation of knowledge are at the heart of the learning process.

Figure 12: A suitable meeting room with movable furniture. (Photo: Gudrun Schwilch)

Figure 13: Fixed and heavy furniture hamper flexible working arrangements for group work, and create unnecessary distance between participants. (Photo: Felicitas Bachmann)

The objective of the 1st MARG Workshop is to identify most suitable NSWRM (existing and potential to be implemented) and collect the information about current experience in case studies. To that end OPTAIN partners suggest the participants should include farmers/practitioners, that are directly implementing the measures within their farms. In some case studies it is advisable to involve farm advisors like agriculture chamber and local agricultural and environmental consultants etc. It is also recommended to restrict the discussion to a selection of up to 10 measures to allow focus on their advantages, drawbacks and arguments for selection in the list of measures implemented. These measures could be the one more common in the area, or the one that have most influence on the local conditions. It is also an option to include most controversial measures into discussion – in order to provide room for discussing the trade-offs.

Practical hints for selecting participants for the stakeholder workshops

From Caspari et al. (2014) adapted for OPTAIN workshop needs

1st MARG WORKSHOP: The objective of the 1st MARG Workshop is to identify most suitable NSWRM (existing and potential to be implemented) and collect the information about current experience in case studies.

Please also check out the OPTAIN MARG workshop report (D1.2) on How to establish the MARG and FAIRWAY example of Norwegian MAP page 9 and slides 47 – 61.

- **Stakeholder analysis**: the stakeholder analysis serves as a basis for selecting workshop participants. Make sure that all relevant stakeholders are represented.
- **Composition of the group**: Ideally the group should be composed of 8 - 10 local stakeholders (land users, local authorities, representatives of local organizations), and based on individual case study interests additional representatives from research, industry, and NGOs). There has to be (1 or) 2 moderators/ facilitators. NOTE: *But this can variate in every case study and should be adapted according to local settings.*
- **Heterogeneity:** in order to have a broad range of expertise and experience represented**,** the group should be interdisciplinary in composition (e.g. from different sectors such as water, agriculture, nature conservation to address the multifunctionality of measures in the discussion), and it should include women and men of different ages. NOTE: this can variate in every case study and should be representative for local settings.
- **Continuity**: though it might not be possible that all people participating in the first stakeholder workshop will/can also participate in the other three workshops, it is essential for the process, that some degree of continuity in participation can be attained throughout the project.

Preparatory work

As a moderator, you need to be prepared for facilitating the stakeholder workshop(s). Besides organizational preparations, it is important that you take enough time to get familiar with the workshop guidelines, with the local context, and think about how you are going to address the topical issues of the workshop.

A suggested **2 to 3 days should be spent for preparation of the workshop**.

Beyond the actual organisation of the workshop (invitations etc.), preparatory tasks may include but are not restricted to:

- Collect information about the study site
  - Collate existing information that you are aware of, in particular existing reports and maps. Go through your answers in the **WP4 questionnaire on the characterization of the local agricultural system** once more. It is necessary that you are aware of agro-ecological conditions, including pressures on water quantity (lack or excess water) and quality (nutrient enrichment, clogging through erosion), pressures on soil (erosion, water shortages or exceedance, loss of nutrients), socio-economic / socio-cultural aspects, particular site-specific features, possible areas of conflict, etc. as such factors have to be considered in the selection and assessment of NSWRMs! Once available, this background information will facilitate your task as a moderator!
  - Go through your filled **WP2 questionnaires on existing and potential NSWRMs** once more. Limit your list of measures to max. 10 and discuss with your colleagues the advantages and disadvantages of each measure. If there are questions regarding the selection procedure, please contact WP2 (tatenda.lemann@unibe.ch)
  - Familiarise yourself with the project internal NSWRM definition and ensure all measures fit into this definition.

- Methodological preparation:
  - Go through the D1.2 MARG workshop report' for MARG specific information (van den Brink et al., 2021b). To help you to find the info about set-up and nurture of MARGs even faster, look at paragraph:
    - How to establish the MARG and FAIRWAY example of Norwegian MAP (page 9/138 and slides 47/138 – 61/138)
    - FAIRWAY example from Slovenia (page 10/27 and slides 62/138 – 71/138)
    - How to facilitate for meaningful engagement in the MARG –issues for consideration (page 11/27 and slides 85/138 – 103/138)
  - Think about which steps can be merged or skipped, e.g. in case of time constraints or if you feel they are not needed in your local context. **A coherent procedure needs to be ensured in this respect**. Don't lose sight of the overall aim of the stakeholder workshop! Please discuss any major adaptations with WP2 coordinators first.

- Think how you can translate theoretical concepts such as “NSWRM” into the words and metaphors of local land users. Use examples and pictures they are familiar with and that are relevant to their life and environment.

- Preparation of working materials
  - Prepare specific materials to be used in the exercises of the stakeholder workshop (see descriptions in the following chapters)
  - Encourage participants to think about existing or potentially suitable NSWRMs in advance

Schedule for a 3h workshop

Points in the agenda	Minutes
Introduction to the workshop	**30**
Introduction to the Project	15
Introduction to the Workshop	15
WP2 Component Existing and potential NSWRM in case study area	**120**
Introduction:	5
Plenary session	30
Exercise #1: Group work: assessment	40
Plenary: presentation group work	30
Exercise #2: Rate NWRMs and selection of 3-5 NWRMs	15
Closure of the workshop	**15**
Wrap up / Evaluation	10
Closure of the workshop	5
Total	**165 (2h45)**

Next Steps:

- Detailed documentation and assessment of local and potential solutions — Summer 2021
- 2nd MARG Workshop: Detailed discussion about measures and indicators: — Autumn/Winter 2021

Introduction to the workshop

Objectives

- To inform the participants briefly on the OPTAIN project
- To inform participants on the objectives and programme of the workshop
- To know expectations of participants
- To prepare the ground for a good working atmosphere

Proposed duration

	Minutes
1. Welcome participants	5
2. Introduction to OPTAIN project	10
3. Objectives and programme of the MARG workshop	10
4. Rules of the game and intended working spirit	5
Total	**30**

Preparations and material required

- Send agenda for the meeting to all potential participants well in advance
- Prepare project flyer in local language.
- Prepare a “OPTAIN Presentation” in local language including agenda, housekeeping rules and objectives of this workshop
- Workshop programme (written on sheets A1)
- Paper sheets, markers, tape

Methodology

Plenary session - presentation

Procedure

- The moderator welcomes participants. Introduce yourself, explain the “housekeeping rules” and mention the agenda. Ask participants to briefly introduce themselves.

- Make a brief presentation of the OPTAIN project and its objectives (include Case Study Leaflets and other WP7 documents). Explain the role of the stakeholder workshop within the whole programme. Point out the importance of the participation in the workshop and thank participants for their interest.

- Present the workshop programme and the objectives. At the beginning of the workshop give an overview of the workshop schedule. This makes it possible to deflate false expectations, and to give a sense of direction.

- For a good working atmosphere ask the participants if they have any questions and/or concerns about the meeting and their involvement. It should not be a formal discussion rather a “friendly” chat.

Expected results

- The participants are clear about objectives, the procedure and programme of the workshop.
- Agreement upon ‘rules of the game’

WP2 Component: Identify existing and potential NSWRM

Objectives

- To identify existing NSWRMs or other interventions not yet applied but potentially suitable for the local context.
- To integrate the perspective, knowledge and experience of external stakeholders.
- To briefly assess already applied and potential solutions.

Proposed Duration

	Minutes
1. Introduction: Definition NSWRMs	5
2. Plenary session: complete list of existing & potential NSWRMs	30
3. Exercise #1: Group work: assessment	40
4. Plenary: presentation group work	30
5. Exercise #2: Rate NWRMs and pre-selection of 3-5 NWRMs	15
Total	**120**

Preparations and material required

- Prepare a few slides with the NWRM definition, the problems to be addressed in the case study, and existing and potentially suitable NSWRM.
- Prepare a flip chart for each group for Exercise #1
- For Exercise #2 prepare a flip chart and paper cards with all selected measures listed (be flexible to also include new measures during the plenary session).

Material:

- Paper sheets, format A1
- Post it cards / paper cards
- Markers (different colours)
- Stickers

Methodology

Plenary session: introduction (NSWRMs) - presentation

Group work: assessment of NSWRMs – flip chart

Plenary session: presentation and discussion of group work. Prioritization of potential measures. Selection of measures to be documented and evaluated in detail after the stakeholder workshop.

Procedure

- **Introduction**: introduce NSWRMs

- **Plenary session**: Specify the problems to be addressed in case study. This can be based on information given to WP4 questionnaires and expert knowledge for the area.
  Present your prepared list with max. 10 existing and potentially suitable NSWRMs (from the WP2 questionnaire) and complete it by **inviting all participants to share their experience and knowledge**, and what they have seen in other places (with similar conditions). Which could be

adequate and potentially interesting and feasible NSWRMs for the local context? Update your list of potential options (PowerPoint or Flip Chart).

NOTE 1: If you have more than 10 measures listed for your case study you should look for most effective/promising measures (see Preparatory work).

NOTE 2: Depending on the specific situation at each case study, there should be an option for informal discussions about case study specific (environmental) problems. This can be presented first by moderators and then participants could be asked to give feedback or complement the existing list.

Exercise #1: Group work:

- **Form** 2-4 groups with 3-5 stakeholders each (depending on the number of participants and OPTAIN researchers) with internal or external participants only. Ideally, local participants are going to assess local solutions while external participants assess potential solutions.

  Distribute the before listed measures among the groups so that each group works on 3 - 5 local or potential solutions.

  Discuss on strengths and weaknesses, potential and constraints of the selected measures. Make a brief but critical assessment on a flip chart considering the following elements:

  - Do the measures belong to NSWRM?.
  - Necessary investments (labour, money)
  - Positive and negative short term / long term effects / impacts
  - Constraints / limiting factors
  - Does the selected measures fit into the concrete local context?
  - Who benefits? Who loses?
  - Who already implements the measure?
  - What is required so that more people start to implement?
  - etc.

- **Plenary session**: presentation and discussion of group work (2-3 min each).

- **Plenary: Exercise #2: Prioritization and selection**
  Let the participants select the 4 to 5 most important local or potential solutions to be documented and evaluated in detail after the workshop. Let them explain why they consider them important. **"Most important" means: has a high potential in the local context, is feasible and effective**.
  Therefore, in the case of potential solutions first make sure (discuss) that they fit these criteria, otherwise take them out of the selection process.

  Prioritization and selection procedure: distribute stickers to everybody. The number of stickers is half the number of measures to select from; i.e. if 8 local and potential solutions have been assessed, everybody gets 4 stickers; in case of 12 measures everybody gets 6 stickers. Everybody has the freedom to distribute his / her stickers as preferred on the flip chart. After everybody has made his / her choice, count the stickers and write down the sum for each of the measures. Those with the biggest number of votes will be favored in the final selection of NSWRMs, which will be documented in detail and integrated into the models after the workshop.

Inform the participants that for the final selection we will also include the following criteria:

- Possibility to integrate the selected NSWRM into the models.
- Representation of NSWRM categories across the project. To ensure that not measures of only a few NWRM categories are documented across the case studies.

- **Identify resource persons**: For each of the selected measure identify persons who already apply the measure, and persons, who could possibly help in the documentation and evaluation process.

Expected results

- A list of potentially interesting and feasible NSWRMS adapted / adaptable to the conditions of the concrete local context.
- A prioritization of NSWRMs to be documented and evaluated after the stakeholder workshop.

Closing of the workshop

Objectives

- Wrap up the info collected during the workshop
- Indicate next steps and activities

Duration

	Minutes
1. Wrap up / Evaluation	5
2. Closure of the workshop	10
Total	**15**

Preparations and material required

- Prepare some open questions for the Evaluation
- Prepare a few slides with next steps, way of communication and the OPTAIN website

Methodology

Plenary session

Procedure

- **Wrap up / Evaluation:** If there is enough time left, initiate a plenary discussion. Use open questions such as
  - What are your benefits/gains from the workshop in terms of understanding the meaning of NSWRM?
  - How did you like the way of learning and working (methodology) in the workshop?
  - Which suggestions do you have to improve the organisation of the workshop?

- **Closure of the workshop**:
  - Start by giving a brief outlook on the next steps of OPTAIN activities at the study site: selection of measures – documentation of selected measures (summer 2021) – next workshop (autumn/winter 2021) – etc.
  - Inform about how you are planning to contact the stakeholders in future and how they can contact you.
  - Ask if they want to get the OPTAIN Newsletter
  - Highlight again the OPTAIN website (link on the leaflet) with the case study specific information in the local languages.

Officially close the workshop and thank all participants for their valuable collaboration.

Expected results

- A feedback from workshop participants: what they liked / disliked, what they
- found useful / useless, necessary improvements, etc.
- Participants are aware of the continuation of the initiated process within OPTAIN
- Way of future communication is defined

References

Caspari, T., van Lynden, G., Bai, Z., Mantel, S., Bachmann, F., & Schwilch, G. (2014). *RECARE WP4 / WP5 Project Guidelines Stakeholder Workshop 1 - Participatory identification of measures to combat soil threats in Europe*.

Schwilch, G., Bachmann, F., & Liniger, H. (2009). Appraising and selecting conservation measures to mitigate desertification and land degradation based on stakeholder participation and global best practices. *Land Degradation & Development*, *20*(3), 308–326. https://doi.org/10.1002/ldr.920

van den Brink C., de Vries A., Nesheim I. and Enge C. 2021a. D1.1: Stakeholder mapping report, covering the case studies. OPTAIN Report. Delivery Date: M6 (February 2021)

van den Brink C., de Vries A., Nesheim I. 2021b. D1.2: Workshop and workshop report on how to establish and nurture MARG for constructive engagement in water – agriculture – environmental conflict related issues. OPTAIN Report. Delivery Date: M6 (28 February 2021)

OPTAIN WP2 Project Guidelines

WP2 Component for 1st MARG VIRTUAL Workshop

Participatory identification of NSWRMs

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Foreword

These guidelines are based on broader methodology developed by the Centre for Development and Environment (CDE), University of Bern, Switzerland, as part of the EU FP6 project **DESIRE** (Schwilch *et al.*, 2008)**.**
https://www.wocat.net/en/projects-and-countries/projects/desire-desertification-mitigation-and-remediation-land-global-approach-local-solutions

In collaboration between CDE and ISRIC-World Soil Information (Wageningen, the Netherlands) the DESIRE guidelines have already been modified to suit the needs of the EU FP7 project **RECARE** (Caspari *et al.*, 2014).
https://www.recare-hub.eu

This guideline has been useful in the above mentioned project and it was decided to follow a similar approach for the OPTAIN project.

For **OPTAIN**, selected chapters of the modified version have been shortened and adapted to serve the project's objectives. Moreover, this version intends to guide the 14 case study leaders during the 1st multi-actor reference groups (MARG) workshop where existing and potentially suitable Natural/Small Water Retention Measures (NSWRMs) are being identified, discussed and selected.

- ⇨ The corresponding original DESIRE guidelines from Schwilch et al. (2014) are available at https://boris.unibe.ch/70305/
- ⇨ The corresponding adapted RECARE guidelines from Caspari et al. (2014) are available at http://www.recare-hub.eu/tools-and-outputs/project-reports

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Contents

Introduction

Stakeholder involvement in OPTAIN

The integrated, transdisciplinary approach of the OPTAIN project aims at initiating a process of co-production of knowledge and joint learning between relevant stakeholders from the local to the (sub-) national level. Thus, in each case study site a range of different stakeholders - from land users, civil society organizations, local authorities to industry and government representatives - will actively be engaged in the process (van den Brink et al 2021a).

The basis of the transdisciplinary approach of the OPTAIN project is a series of participatory stakeholder workshops to be carried out in all 14 case study areas.

For a flowchart and indicative timeline of stakeholder involvement in OPTAIN, see OPTAIN D1.1

WP2's particular interest lays in the **1st and 2nd MARG meetings/workshops,** where we aim at collecting missing information and discussing practicalities connected to existing (and potential) measures in case studies areas:

- MARG workshop 1: Identification of current / potential measures
- MARG workshop 2: Detailed discussion about measures, indicators and scenarios.

In order to help Case Study leaders and/or MARG leaders, WP2 will prepare detailed methodological guidelines for each of the two workshops we are involved in.

The present guidelines are intended for use in the 1st MARG workshop.

Stakeholder Workshops

General information

The workshops are a cornerstone of stakeholder participation and aim at enabling transdisciplinary learning processes throughout the project, i.e. learning processes between scientific and non-scientific actors. Thus, the workshops provide opportunities to initiate, promote and deepen a mutual learning process between the researchers and a range of relevant stakeholders (e.g. land managers, food producers, developers, industry, regulators, advisory services, authorities, experts) that have some kind of interest in the topic of soil threats and water and nutrient cycles in the case study sites. Each of the stakeholders - representing science, practice or policy making - have their own perspectives and will contribute to the intended dialogue and process of knowledge exchange and learning with their own expertise and experience (Schwilch et al., 2009). Given that the knowledge contributed by scientific and non-scientific actors is valued equally in this process, and that local and scientific knowledge can be integrated to some extent, it is expected that more sustainable solutions can be identified and implemented. Workshop participants are expected to engage in a dialogue by sharing their knowledge and experience in regard to the soil threats and current water and nutrient losses or potential for retention/reuse, and by contributing to a joint reflection, decision-making and evaluation process in regard to mitigation and remediation measures.

Practical hints for organizing a virtual stakeholder workshop

Check out the OPTAIN MARG workshop report (D1.2) on how to facilitate for meaningful engagement in the MARG – issues for consideration: Page 11 and slides 85 -103

- **Scheduling**: The timing of workshops is determined primarily by the availability of the participants, particularly land users, which means considering the agricultural calendar!

- **Software program**: For this workshop the selected video telephony software should include the following minimal features:
    - Breakout rooms – for Exercise 1
    - Whiteboard – for Exercise 1 and 2
    - Poll function (optional) – for icebreaker Exercise 2 and evaluation

- **Suggested software programs:** Select a software you know, and you feel comfortable with. Check with your institution for which software programs you have a license or which software programs they propose.

    If you have no license or software program available, please contact the OPTAIN coordinators to find a solution.

- **Potential programs** that can be of considerations are:
    - **Zoom** (https://zoom.us/)
      Please be aware that the free (basic) option only allows group meetings for up to 40 minutes and is therefore not appropriate for this workshop. You will need a pro license or higher (https://zoom.us/pricing).
      Edit your settings in advance:
        - Require a passcode when scheduling a new meeting: Highly recommended for security reasons.
        - Waiting Room: Can be helpful to keep the overview of who is participating. But be aware that you will have to admit the participants individually.
        - We recommend to not allow participants to join the meeting before you as a host arrive.
        - Allow meeting participants to send a message visible to all participants.
        - Allow participants to send a private 1:1 message to another participant.
        - Save the chats automatically to not forget to do it at the end of the meeting.
        - Allow to add co-hosts. This will easily enable you to give others the right to e.g. share their screen.
        - If you plan to use a poll, allow to use “polls” in meetings. Prepare the poll before:https://support.zoom.us/hc/en-us/articles/213756303-Polling-for-meetings
        - Allow the host and participants to share a whiteboard during a meeting. Prepare the whitebord before: https://www.youtube.com/watch?v=jQ4-wrwHAxk
        - Allow participants to rename themselves. That will make it easier for everybody to enter the proper name.
        - Allow to split the meeting participants into separate smaller rooms (breakout room). Prepare and name the breakout rooms before: https://support.zoom.us/hc/en-us/articles/206476093-Enabling-breakout-rooms
        - Check all other settings to see what is relevant for you.
        - Schedule a meeting before you send out the invitation. That will give you the right link for this specific meeting.

    - **Teams** (https://www.microsoft.com/en-ww/microsoft-teams/group-chat-software)
      Please be aware that the free option only allows group meetings for up to 60 minutes and is therefore not appropriate for this workshop. Basic and Standard options can be tried

for free for 1 month. But do not forget possible virtual follow-up meetings or other upcoming OPTAIN workshops.
(https://www.microsoft.com/en-ww/microsoft-teams/compare-microsoft-teams-options?market=af) .

- Here you can find an instruction on how to use the Teams whiteboard: https://www.youtube.com/watch?v=YBnojDFXo4k
- Here you can find instructions on how to add a poll to your Teams channel: https://support.microsoft.com/en-us/office/add-a-poll-to-your-teams-channel-or-chat-a3f9112c-01e1-4ee4-bd88-25e4e243b80b
- Here you get information about the use of breakout rooms: https://support.microsoft.com/en-us/office/use-breakout-rooms-in-teams-meetings-7de1f48a-da07-466c-a5ab-4ebace28e461

- **Skype** (www.skype.com)
  To our knowledge the breakout room function is not available yet in Skype. Therefore we recommend Skype only for a small group where no additional chat rooms are needed for the group work.
  Note: Skype for Business will be retired on July 31, 2021, after which it will no longer be accessible or supported

- **Other options** including breakout room and whiteboard:
  - BlueJeans: www.bluejeans.com
  - GoToMeeting: www.gotomeeting.com
  - ...

- For a an **"external" whiteboard** there are several options possible:
  - miro (https://miro.com/)
  - NoteBookCast (https://www.notebookcast.com/)
  - MURAL (https://www.mural.co/)
  - ...

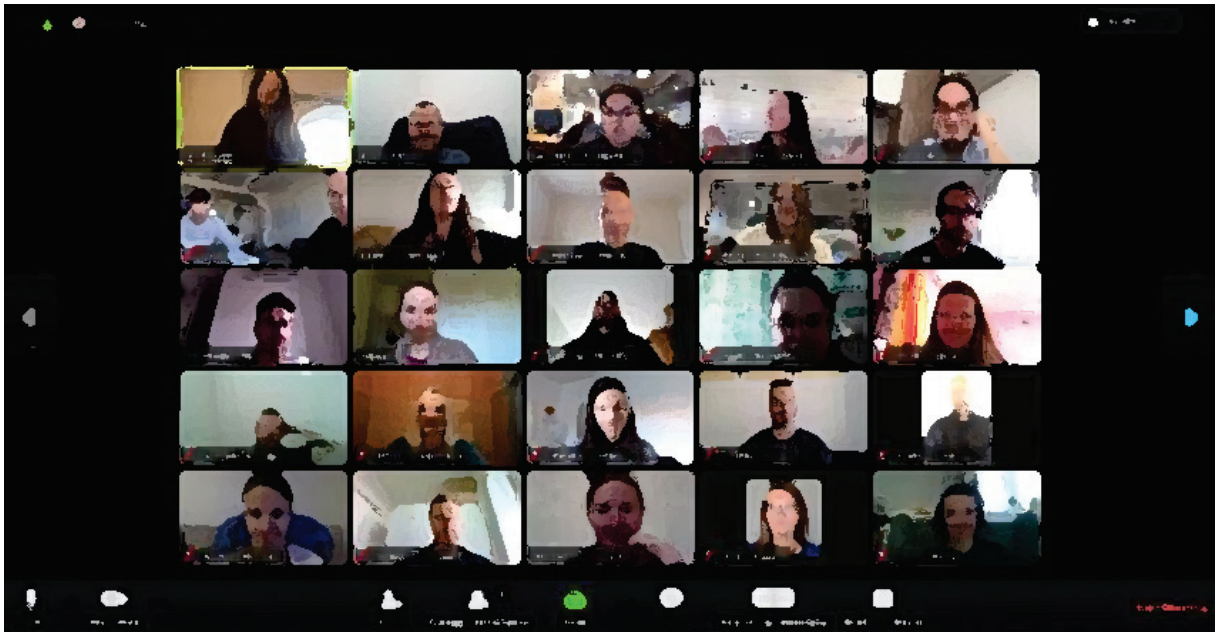
  It is also possible for the moderator to only share her/his screen and take the notes from all participants in a designed ppt, word or excel document.

- For **polls** (e.g. ice breaker) we propose to use in-build poll functions (e.g. in zoom) but there are also online features like, for example:
  - Kahoot (https://kahoot.com/).
  - Slido (https://www.sli.do/)
  - Mentimeter (https://www.mentimeter.com/)
  - WooClap (https://www.wooclap.com/)
  - ...

- **Invitation:** Share the link of the virtual platform for the meeting in all mails and documents related to the workshop. That helps the participants who try to login only a few minutes before the workshop starts. Send out a meeting invitation (e.g. Outlook) with the activated "request responses" option.
  Send out a reminder on the day of the workshop itself including the link and the detailed agenda.

Selecting workshop participants – 1st MARG workshop
(Caspari et al., 2014) adapted for OPTAIN workshop needs

The general objectives of all stakeholder workshops are: 1) To strengthen trust and collaboration among concerned stakeholders, and 2) to enable and foster a mutual learning process among scientific and non-scientific stakeholders (among them local land users as well as researchers, representatives of the local administration, NGOs, GOs etc.). The learning process is characterized by creating a common understanding of problems, potentials and opportunities through integration of the perceptions and knowledge of all stakeholders involved, in order to identify possible solutions to the soil threats (Schwilch et al 2009). Thus, sharing one's knowledge and experience, joint reflection and dialogue, and co-creation of knowledge are at the heart of the learning process.



Example of a virtual Zoom meeting

The objective of the 1st MARG Workshop is to identify most suitable NSWRM (existing and potential to be implemented) and collect the information about current experience in case studies. To that end OPTAIN partners suggest the participants should include farmers/practitioners, that are directly implementing the measures within their farms. In some case studies it is advisable to involve farm advisors like agriculture chamber and local agricultural and environmental consultants etc. It is also recommended to restrict the discussion to a selection of up to 10 measures to allow focus on their advantages, drawbacks and arguments for selection in the list of measures implemented. These measures could be the one more common in the area, or the one that have most influence on the local conditions. It is also an option to include most controversial measures into discussion – in order to provide room for discussing the trade-offs.

Practical hints for selecting participants for the stakeholder workshop
From Caspari et al. (2014) adapted for OPTAIN workshop needs

1st MARG WORKSHOP: The objective of the 1st MARG Workshop is to identify most suitable NSWRM (existing and potential to be implemented) and collect the information about current experience in case studies.

Please also check out the OPTAIN MARG workshop report (D1.2) on How to establish the MARG and FAIRWAY example of Norwegian MAP page 9 and slides 47 – 61

- **Stakeholder analysis**: the stakeholder analysis serves as a basis for selecting workshop participants. Make sure that all relevant stakeholders are represented.
- **Composition of the group**: Ideally the group should be composed of 8 - 10 local stakeholders (land users, local authorities, representatives of local organizations), and based on individual case study interests additional representatives from research, industry, and NGOs). There has to be (1 or) 2 moderators/ facilitators. *NOTE: But this can variate in every case study and should be adapted according to local settings.*
- **Heterogeneity:** in order to have a broad range of expertise and experience represented**,** the group should be interdisciplinary in composition (e.g. from different sectors such as water, agriculture, nature conservation to address the multifunctionality of measures in the discussion), and it should include women and men of different ages. NOTE: this can variate in every case study and should be representative for local settings.
- **Continuity**: though it might not be possible that all people participating in the first stakeholder workshop will/can also participate in the other three workshops, it is essential for the process, that some degree of continuity in participation can be attained throughout the project.

Preparatory work

As a moderator, you need to be prepared for facilitating the stakeholder workshop(s). Besides organisational preparations, it is important that you take enough time to get familiar with the software program, with the workshop guidelines, with the local context, and think about how you are going to address the topical issues of the workshop.

A suggested **2 to 3 days should be spent for preparation of the workshop.**

Beyond the actual organisation of the workshop (invitations etc.), preparatory tasks may include but are not restricted to:

- Software program
  - Download the program on your computer if you haven't done so far.
  - Get familiar with the program and the available functions.
  - Get a headset and microphone and test your audio and video.
  - Prepare the breakout rooms, the whiteboard and possible polls and test it in a preparatory meeting with your colleagues.
  - Review how to share your screen.
  - For the meeting close unnecessary tabs in your browser and turn off notifications such as Email or messaging.
  - Study some Best Practices in a virtual meeting (e.g.it.umn.edu/services-technologies/how-tos/zoom-best-practices-in-meeting-one-page)

- Collect information about the study site
  - Collate existing information that you are aware of, in particular existing reports and maps. Go through your answers in the **WP4 questionnaire on the characterization of the local agricultural system** once more. It is necessary that you are aware of agro-ecological conditions, including pressures on water quantity (lack or excess water) and quality (nutrient enrichment, clogging through erosion), pressures on soil (erosion, water shortages or exceedance, loss of nutrients), socio-economic / socio-cultural aspects, particular site-specific features, possible areas of conflict, etc. as such factors have to be considered in the selection and assessment of NSWRMs! Once available, this background information will facilitate your task as a moderator!

  - Go through your filled **WP2 questionnaires on existing and potential NSWRMs** once more. Limit your list of measures to max. 10 and discuss with your colleagues the advantages and disadvantages of each measure. If there are questions regarding the selection procedure, please contact WP2 (tatenda.lemann@unibe.ch)

  - Familiarise yourself with the project internal NSWRM definition and ensure all measures fit into this definition.

- Methodological preparation:
  - Go through the D1.2 MARG workshop report' for MARG specific information (van den Brink et al., 2021b). To help you to find the info about set-up and nurture of MARGs even faster, look at paragraph:
    - *How to establish the MARG and FAIRWAY example of Norwegian MAP (page 9/138 and slides 47/138 – 61/138)*
    - *FAIRWAY example from Slovenia (page 10/27 and slides 62/138 – 71/138)*
    - *How to facilitate for meaningful engagement in the MARG –issues for consideration (page 11/27 and slides 85/138 – 103/138)*

  - Think about which steps can be merged or skipped, e.g. in case of time constraints or if you feel they are not needed in your local context. **A coherent procedure needs to be ensured in this respect**. Don't lose sight of the overall aim of the stakeholder workshop! Please discuss any major adaptations with WP2 coordinators first.

  - Think how you can translate theoretical concepts such as "NSWRM" into the words and metaphors of local land users. Use examples and pictures they are familiar with and that are relevant to their life and environment.

- Preparation of working materials
  - Prepare specific materials to be used in the exercises of the stakeholder workshop (see descriptions in the following chapters)
  - Encourage participants to think about existing or potentially suitable NSWRMs in advance

Schedule for a 2h workshop

Points in the agenda	Minutes
Introduction to the workshop	**15**
Introduction to the Project	7
Introduction to the Workshop	8
WP2 Component Existing and potential NSWRM in case study area	**100**
Introduction	5
Plenary session	25
Exercise #1: Group work: assessment	35
Plenary: presentation group work	25
Exercise #2: Rate NWRMs and selection of 3-5 NWRMs	10
Closure of the workshop	**5-10**
Wrap up / Evaluation	5
Closure of the workshop	5
Total	**120**

Next Steps:

- Detailed documentation and assessment of local and potential solutions — Summer 2021
- 2nd MARG Workshop: Detailed discussion about measures and indicators — Autumn/Winter 2021

Introduction to the workshop

Objectives

- To inform the participants briefly on the OPTAIN project
- To inform participants on the objectives and programme of the workshop
- To know expectations of participants
- To prepare the ground for a good working atmosphere

Proposed duration

	Minutes
1. Welcome participants	
2. Introduction to OPTAIN project	7
3. Objectives and programme of the MARG workshop	8
Total	**15**

Preparations and material required

- Send agenda for the meeting to all potential participants well in advance (see above in Chapter 2, Invitation).
- Prepare project flyer in local language.
- Prepare a "OPTAIN Presentation" in local language including agenda, housekeeping rules and objectives of this workshop (see Chapter 3).
- *Optional: prepare one or several icebreaker poll questions.*

Methodology

Plenary session - presentation

Procedure

- The moderator welcomes participants. Introduce yourself, explain the "housekeeping rules" and mention the agenda. Ask participants to briefly introduce themselves.
  If you want to record the meeting, do not forget to ask if everybody agrees and to turn on the recording tab.

- Make a brief presentation of the OPTAIN project and its objectives (include Case Study Leaflets and other WP7 documents). Explain the role of the stakeholder workshop within the whole programme. Point out the importance of the participation in the workshop and thank participants for their interest.

- Present the workshop programme and the objectives. At the beginning of the workshop give an overview of the workshop schedule. This makes it possible to deflate false expectations, and to give a sense of direction.

- For a good working atmosphere, ask the participants if they have any questions and/or concerns about the meeting and their involvement. It should not be a formal discussion, rather a "friendly" chat.

Expected results

- The participants are clear about objectives, the procedure and programme of the workshop.
- Agreement upon 'rules of the game'

WP2 Component: Identify existing and potential NSWRM

Objectives

- To identify existing NSWRMs or other interventions not yet applied but potentially suitable for the local context.
- To integrate the perspective, knowledge and experience of external stakeholders.
- To briefly assess already applied and potential solutions.

Proposed Duration

	Minutes
1. Introduction: Definition NSWRMs	5
2. Plenary session: complete list of existing & potential NSWRMs	25
3. Exercise #1: Group work: assessment	35
4. Plenary: presentation group work	25
5. Exercise #2: Rate NWRMs and pre-selection of 3-5 NWRMs	10
Total	**100**

Preparations and material required

- Prepare a few slides with the NWRM definition, the problems to be addressed in case study, and existing and potentially suitable NSWRM.
- Prepare a whiteboard in your software program or a slide for each group for Exercise #1
- For Exercise #2 prepare a poll (multiple answers) or whiteboard with all selected measures listed (be flexible to also include new measures during the plenary session). If you use the whiteboard, think about voting possibilities (points, lines, stickers) depending on the software programme used.

Methodology

Plenary session: introduction (technologies, approaches) - presentation

Group work: assessment of NSWRMs – whiteboard / ppt for each group

Plenary session: presentation and discussion of group work. Prioritization of potential technologies and approaches. Selection of technologies / approaches to be documented and evaluated in detail after the stakeholder workshop.

Procedure

- **Introduction**: introduce NSWRMs

- **Plenary session**: Specify the problems to be addressed in case study. This can be based on information given to WP4 questionnaires and expert knowledge for the area.
  Present your prepared list with max. 10 existing and potentially suitable NSWRMs (from the WP2 questionnaire) and complete it by **inviting in all participants to share their experience and knowledge**, and what they have seen in other places (with similar conditions). Which could be adequate and potentially interesting and feasible NSWRMs for the local context? Update your list of potential options.

NOTE 1: If you have more than 10 measures listed for your case study you should look for most effective/promising measures (see Preparatory work).

NOTE 2: Depending on the specific situation at each case study, there should be an option for informal discussions about case study specific (environmental) problems. This can be presented first by moderators and then participants could be asked to give feedback or complement the existing list.

- **Exercise #1: Group work**: Form 2-4 groups with 3-5 stakeholders each (depending on the number of participants and OPTAIN researchers) with internal or external participants only. Ideally, local participants are going to assess local solutions while external participants assess potential solutions.

  Distribute the before listed measures among the groups so that each group works on 3 - 5 local or potential solutions.

  Discuss on strengths and weaknesses, potential and constraints of the selected items. Make a brief but critical assessment considering the following elements:

  - Do the measures belong to NSWRM?
  - Necessary investments (labour, money)
  - Positive and negative short term / long term effects / impacts
  - Constraints / limiting factors
  - Does the selected item fit into the concrete local context?
  - Who benefits? Who loses?
  - Who already implements the technology?
  - What is required so that more people start to implement?
  - etc.

- **Plenary session**: presentation and discussion of group work (2-3 min each).
- **Plenary: Exercise #2: Prioritization and selection**. Let the participants select the 4 to 5 most important local or potential solutions to be documented and evaluated in detail after the workshop. Let them explain why they consider them important. **"Most important" means: has a high potential in the local context, is feasible and effective**.

  Therefore, in the case of potential solutions first make sure (discuss) that they fit these criteria, otherwise take them out of the selection process.

  Use the prepared poll (multiple answers) or whiteboard with all the discussed measures listed. Distribute a number of votes to everybody. The number of votes is half the number of measures to select from; i.e. if 8 local and potential solutions have been assessed, everybody gets 4 votes; in case of 12 items everybody gets 6 cotes. Everybody has the freedom to distribute his / her votes as preferred. After everybody has made his / her choice, count the votes and write down the sum for each of the items. Those with the biggest number of votes will be favored in the final selection of NSWRMs, which will be documented in detail and integrated into the models after the workshop.

Inform the participants that for the final selection we will also include the following criteria:

- Possibility to integrate the selected NSWRM into the models.

- Representation of NSWRM categories across the project. To ensure that not measures of only a few NWRM categories are documented across the case studies.

- **Identify resource persons**: For each of the selected items identify persons who already apply the measure, and persons, who could possibly help in the documentation and evaluation process

Expected results

- A list of potentially interesting and feasible NSWRMS adapted / adaptable to the conditions of the concrete local context.
- A prioritisation of NSWRMs to be documented and evaluated after the stakeholder workshop.

Closing of the workshop

Objectives

- Wrap up the info collected during the workshop
- Indicate next steps and activities

Duration

	Minutes
1. Wrap up / Evaluation	5
2. Closure of the workshop	5
Total	**5-10**

Preparations and material required

- Prepare some open questions for the Evaluation
- Prepare a few slides with next steps, way of communication and the OPTAIN website

Methodology

Plenary session

Procedure

- **Wrap up / Evaluation:** If there is enough time left, initiate a plenary discussion. Use open questions such as
  - What are your benefits/gains from the workshop in terms of understanding the meaning of NSWRM?
  - How did you like the way of learning and working (methodology) in the workshop? Did it go well to discuss in virtual breakout groups, was the technicalities ok?
  - What are positive and negative aspects associated with this virtual in contrast to a physical meeting?
  - What did you miss and which suggestions do you have to improve the organisation of the workshop?

- **Closure of the workshop**:
  - Start by giving a brief outlook on the next steps of OPTAIN activities at the study site:
    selection of measures – documentation of selected measures (summer 2021) – next workshop (autumn/winter 2021) – etc.
  - Inform about how you are planning to contact the stakeholders in future and how they can contact you.
  - Ask if they want to get the OPTAIN Newsletter
  - Highlight again the OPTAIN website (link on the leaflet) with the case study specific information in the local languages.

Expected results

Officially close the workshop and thank all participants for their valuable collaboration.

- A feedback from workshop participants: what they liked / disliked, what they
  found useful / useless, necessary improvements, etc.
- Participants are aware of the continuation of the initiated process within OPTAIN
- Way of future communication is defined

References

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Annex 3: Report about the first MARG workshops

Case studies / countries	Meeting type / Nr of participants	Date	Identify measures during ws	Exercise #1	Exercise #2	Difficulties encountered	Changes made	Interest by participants	Comments
1 - Germany: Schwarzer Schoeps	- Online meeting (Cisco Webex) - 13 participants - 1 participant, head of regional farmer association had technical problems and could not join meeting, prefers physical meetings. - Note: no farmers in meeting.	21 and 28 April 2021 (2 workshop)	Done	Done	Mentimeter for rating; each participant had 100 points	- Time (3h) too short, not all measures could be discussed. - Some measures shared after the Ws by participants, were not included in rating. - Isolated view on measures not good, have to be combined.	- Increased no. of measures, but run into time constraints. - Used mentimeter for prioritisation.	- Good, positive impression	
2 - Switzerland: Petite Glâne	- Physical meeting - 8 participants	8. July 2021	Done	SWOT Analysis following the critical parameters of the WP2 Questionnaire	- Prioritisation through discussion by excluding unpopular measures. - No points were given as farmers did not want to focus on single measures only (had holistic approach in mind).	- Ws was during a busy time for farmers (not ideal). - 3h was not enough time to discuss all measures. - Concept of measures as technologies was difficult to understand for farmers. Wanted to focus on	- Measures were not prioritised, measures were selected based on exclusion.	- Participants were very interested.	- Moderation was done by agriculture extension worker. This was very useful as he knew study site and stakeholders.

Case studies / countries	Meeting type / Nr of participants	Date	Identify measures during ws	Exercise #1	Exercise #2	Difficulties encountered	Changes made	Interest by participants	Comments
						overall objectives. - a few dominant stakeholders monopolised discussion.			
3 - Hungary: Csorsza and Felső-Válicka stream catchment	- Online meeting with Zoom - 28 participants - Had bilateral meetings with farmers and farmers advisors	16. April 2021	Done	- asked participants single and multiple choice questions regarding NSWRM - critical assessment of MSWRM based on bilateral meetings and knowledge of experts in soil management.	Zoom Pooling; Prioritisation was completed based on one-to-one discussion with advisors, farmers and municipality.	- farmers prefer physical meetings	- Zoom Pooling used - critical assessment of NSWRM was made based on bilateral meetings with farmers, advisors and municipality.	- Participants were interested	
11 - Hungary: Tetves stream catchment (same ws approach as above in 2nd Hungary case study)	- Online Meeting with Zoom - 28 participants, including farmer - Contacted the major and farmer in May after ws - Additional 8 researcher from ATK participated in ws.	16. April 2021	Done	- asked participants single and multiple choice questions regarding NSWRM	Zoom Pooling; Prioritisation was completed based on one-to-one discussion with advisors, farmers and municipality.	- farmers prefer physical meetings	- Zoom Pooling used - farmers critically assessed the MSWRMS before ws.	- Participants were interested	
4 - Poland: Upper Zgłowiączka catchment	- Physical workshop - 24 participants - Not all participants	2. July 2021		- critical assessment was done in the form of a roundtable discussion (plenary).	- done in the larger group (3 participants had left the ws) - Measure were on	- Keep discussion in small group on topic of measures. - not enough time to	- meeting was combined with another initiative to establish a local water partnership. - Audience was larger than	- high interest with farmers (water law company), water management and county	- meeting combined with other initiative; was a good opportunity, but they had

Case studies / countries	Meeting type / Nr of participants	Date	Identify measures during ws	Exercise #1	Exercise #2	Difficulties encountered	Changes made	Interest by participants	Comments
	participated in group work			- discussion was done in a smaller group	paper, participants could rate the measures from 5 (top) to 1 (bad).	discuss all the measures due to other issues popping up.	planned for MARG, shorter group discussion on measures and restricted to one stakeholder group.	administration group - Other groups had lower interest.	less time to discuss measures (trade-off). - farmer and project have different interests, farmers rather short-term and profit oriented, project long-term (climate related) 2100. - Application of NSWRM seems to be difficult. - included additional measure, which are not listed as NSWRs
7 - Belgium, Wimbe basin	- Online meeting - 13 participants (no farmers: were busy and prefer physical meetings)	3 May 2021		- done in plenary by menti.com (no discussion in smaller groups)	- used menti.com using multiple choice with multiple answers app	- farmers did not attend online meeting; was also busy field time for them.	- exercise 1 was done in plenary with menti.com (not in small groups)	- hard to tell as it was virtual, but is seemed that they were interested and participated through menti.com	
8 - Lithuania: Dotnuvėlė	- Online meeting - 11 participants - farmers prefer physical meeting and were busy during that time.	17 March 2021	No solutions were identified, only issues were discussed	- no concrete solutions were identified and prioritised	- was not done	- silent listeners in the meeting - technical problems: unstable internet connection / difficult to hear partcipants	- Ws focused on general discussion, measure implementation guidelines, policy background and getting to know each other (no selection of measure was done)	- Only a limited number of participants was speaking. - interesting policy issues were brought up.	- Recommend physical meetings as remote conversation was difficult.

Case studies / countries	Meeting type / Nr of participants	Date	Identify measures during ws	Exercise #1	Exercise #2	Difficulties encountered	Changes made	Interest by participants	Comments
9 - Italy: Cherio	- Online meeting (roundtable discussion: no proposed tools were used) - 9 participants	19 May 2021	Done	- done in round table format (no tools used)	- done in round table format. No prioritisation was made. - information about measures was entered.	- no: some participants were more aware about the problems than others	- Ws focused on a general discussion to get to know the case study and problems better. - no proposed tools were used / no prioritisation made.	- Participants were interested and participated.	- Prefer in-person meeting in future
12 - Czech Republic: Čechtický stream catchment	- I guess online (do not mention it) - 11 participants	18 May 2021	Done	- done based on completed questionnaires	- done based on questionnaire and discussion with stakeholders.	- not all participants could stay for the whole ws.	NA	- Participants were mainly from agricultural sector	
13 - Latvia Dviete	- 2h physical workshop done. - 12 participants - Exercise #1: group work and Exercise #2 not done due to the short physical workshops. These activities will be in MARG II in autumn 2021.	15th July 2021		Not done, will be done in autumn 2021	Not done, will be done in autumn 2021	NA	NA	NA	NA
10 - Norway, Vansø-Hobøl (sub-catchment: Krakstadelva)	- Changed structure of workshop. Did MARG kick-off (several meeting on Teams) **MARG kick-off:** 28.1.21 and 29.1.21; Phone calls with farmers (April to May 2021);	Jan to May 2021	NA: studied reports of existing projects	NA: studied reports of existing projects	NA: selected based on existing project / survey with farmers.	- Discuss win-win synergies and win-lose situations of measures.	- Catchment is already very well studies by a lot of projects. Therefore, decided to separate the tasks of the 1st MARG meeting into a **MARG kick-off meeting** and a **1st MARG data collection activity** to avoid	- in MARG kick-off: participants were interested	

Case studies / countries	Meeting type / Nr of participants	Date	Identify measures during ws	Exercise #1	Exercise #2	Difficulties encountered	Changes made	Interest by participants	Comments
	authorities via e-mail. **1st MARG data collection activity:** based on already existing information from other projects (2020).						stakeholder fatigue.		
5 - Slovenia, Pesnica	- Physical meeting - 14 participants	6.9.21	NA	NA	- Measure were presented and discussed.	- physical ws with Covid certificate. Less participants attended than expected.	- project presented, measures presented and discussed. No prioritisation made.	- Participants were interested. Ministry of Agriculture did not attend due to Covid measures.	- Next meeting organize more according to interests of stakeholders. As hybrid meeting or in the field.
6 - Slovenia, Kobilje	- Physical meeting - 21 participants	9.9.21	Done	NA	- Measure were presented and discussed.	- physical ws with Covid certificate. Less participants attended than expected.	- project presented, measures presented and discussed. No prioritisation made.	- Participants were interested. Ministry of Agriculture did not attend due to Covid measures.	- Next meeting organize more according to interests of stakeholders. As hybrid meeting or in the field.
11 – Sweden, Sävjaån Headwaters	Different approach for stakeholder involvement – therefore no report of 1st MARG meeting available								